[illegible] 16.07.2013 T/FM.02.02
[illegible]

[illegible]

[illegible]

[illegible]

05.02.01 [illegible]

[illegible]

[illegible] 2016

[illegible] 669:583.9, 669:14.018, 621:74.04

[illegible]

[illegible]

Content of the abstract of doctoral dissertation

[illegible]
[illegible] 16.07.2013 T/FM.02.02
[illegible]

[illegible]

[illegible]

[illegible]

05.02.01 [illegible]

[illegible]

[illegible] 2016

Докторлик диссертацияси мавзуси Ўзбекистон Республикаси Вазирлар Маҳкамаси ҳузуридаги Олий аттестация комиссиясида 30.09.2014/B2014.5.T313 рақам билан рўйхатга олинган.

Докторлик диссертацияси Тошкент давлат техника университетида бажарилган.

Диссертация автореферати уч тилда (ўзбек, рус, инглиз) Илмий кенгаш веб-саҳифанинг www. tadqiqotchi@tdtu.uz ҳамда «ZiyoNet» ахборот-таълим портали www.ziyonet.uz манзилларига жойлаштирилган.

Расмий оппонентлар:	**Джумабаев Алижон Бекишевич** техника фанлари доктори, профессор
	Михридинов Рискидин Михридинович техника фанлари доктори, профессор
	Абдуллаев Фатхулла Сагдуллаевич техника фанлари доктори, профессор
Етакчи ташкилот:	**Навоий давлат кончилик институти**

Диссертация ҳимояси Тошкент давлат техника университети ва Ўзбекистон Миллий университети ҳузуридаги 16.07.2013 T/FM.02.02 рақамли Илмий Кенгашнинг «28» 07 2016 йил соат 14:00 даги мажлисида бўлиб ўтади. (Манзил: 100095, Тошкент, Университет кўч., 2. Тел/факс (99871) 227-10-32, e-mail: tadqiqotchi@tdtu.uz).

Докторлик диссертацияси билан Тошкент давлат техника университети Ахборот-ресурс марказида танишиш мумкин (16 рақам билан руйхатга олинган).

(Манзил: 100095, Тошкент, Университет кўч. 2. Тел. (99871) 246-46-00).

Диссертация автореферати 2016 йил « 8 » 07 куни тарқатилди.

(2016 йил « 8 » 07 даги 16 рақамли реестр баённомаси).

К.А. Каримов
Фан доктори илмий даражасини берувчи
илмий кенгаш раиси, т.ф.д., профессор

Н.Д. Тураходжаев
Фан доктори илмий даражасини берувчи
илмий кенгаш илмий котиби, т.ф.н., доцент

Р.М. Михридинов
Фан доктори илмий даражасини берувчи
илмий кенгаш ҳузуридаги илмий семинар
раиси, т.ф.д., профессор

[illegible]

[illegible] [illegible] 8-10 [illegible] 2-3 [illegible] 6-7 [illegible]

[illegible]

[illegible]

[illegible] 2006 [illegible] 14 [illegible] 530-[illegible] 2011 [illegible] 29 [illegible] 1590-[illegible] 2011-2013 [illegible]

[illegible] [illegible] II. [illegible] VII. [illegible]

[illegible][1].

[illegible] (laboratory of nationally Roskilde, USA); [illegible] (laboratory of nationally Argon, USA); [illegible]

[illegible]

[illegible]

[1] [illegible] Y.Zhang and J.Zhang, ñNanometer WC-Co Carbideò, Xiyou Jinshu Cailiao Yu Gongcheng, 1995, 24(2), 18-21 (Chinese); High Temperature Synthesis of WC in a CH4/H2 Gas Atmosphereò, Poroshk. Metall. (Kiev) 1995 (9-10) 21-26 (Russian); L.Gao and B.H.Kear, ñSynthesis of Nanophase WC Powder by a Displacement Reaction Processò, NanoStructured Materials, 9, 205-208, 1997; H.Kear, P.R.Strutt, ñChemical Processing and Applications for Nanostructured Materialsò, NanoStruct. Mater. 1995 6(1-4), 227-236; A.V.Samokhin, N.V.Alexeev, Yu.V.Blagoveschenskiy, S.A.Kornev, Yu.V.Tsvetkov, W-C nanosized composition synthesis and characterization, 9-th International Conference on Nanostructured Materials, Brazil, 1-5 June, 2008; Y.V. Blagoveshchenskiy, A.V. Samokhin, Y.V. Tsvetkov, N.V. Alexeev, N.V. Isaeva, C.A. Kornev , Y.I. Melnik. Nanopowders of WC-Cts system with different inhibitor additions manufacturing by plasmochemical process. 17 Plansee Seminar ï International Conference on High Perfomance P/M Materials. Reutte, Austria, May 25-2-, 2009, Vol.3, GT 23/1-5;Samokhin A.V., Alexeev N.V., Kornev S.A., Tsvetkov Yu.V., W-C nanosized composition synthesis and characterization, 19th International Symposium on Plasma Chemistry (ISPC-19), Bochum, Germany, July 25 - 31, 2009. [illegible]

[illegible]

[illegible]

[illegible] G. Bennig, K. Kuatt, K. Gerber, H. Kroto, J. Health, S. OâBrien, R. Curl, R. Smalley [illegible]

[illegible]

[illegible]

[illegible]

[illegible] 10ï 15 [illegible] (2009-2010) [illegible] 2012ï 5ï 13 [illegible]

/

(2013–2014); [illegible] -2015-7-8 «[illegible]» (2015–2016) [illegible]

[illegible] [illegible]

[illegible]:

[illegible];

[illegible];

[illegible];

[illegible] 300 [illegible];

[illegible];

[illegible];

[illegible].

[illegible] [illegible] -TiC [illegible] 6, [illegible] 8, [illegible] 15 ([illegible] 3882–74) [illegible] 6M5 ([illegible] 19265–73) [illegible] 40[illegible] 40[illegible] ([illegible] 977–75) [illegible]

[illegible]. [illegible]

[illegible]. [illegible]

[illegible]:

[illegible]

IAP 04728 (05.06.2013).

IAP 04531 (27.02.2012).

[illegible] IAP 04732 (26.06.2013). [illegible]

[illegible] 2016 [illegible] 11 [illegible] 16/22-[illegible]). [illegible] 1,2-1,3 [illegible]

[illegible] [illegible] 10 [illegible] «[illegible] 2009, 2010, 2011, 2012, 2013, 2014» ([illegible]), «[illegible]» ([illegible], 2010), «[illegible]» ([illegible], 2010), «[illegible]» ([illegible], 2010), «[illegible]» ([illegible], 2010) [illegible]

[illegible] [illegible] 32 [illegible] 14 [illegible], 12 [illegible] 2 [illegible] 3 [illegible]

[illegible] [illegible] 196 [illegible]

$$L_S \approx \frac{1}{P \cdot \tau \cdot \rho \cdot \sqrt{Q \cdot \tau}} \ , \qquad (1)$$

[illegible]

[illegible]

$$n_c \cdot \lambda^2 \approx 10^{15} \frac{1}{[illegible]} \quad [illegible] \qquad (2)$$

[illegible] n_c [illegible] λ [illegible] $\lambda = 1$ [illegible] $n_c \cong 10^{27}$ [illegible] (1-[illegible]). [illegible] 10^4 [illegible].

[illegible] (1-[illegible]) [illegible]:

$$U_o = \frac{G_{H2}}{S_B}, \quad [illegible] \qquad (3)$$

[illegible] G_{H2} [illegible]; S_B [illegible].

[illegible] (1-[illegible]) [illegible] I [illegible] II [illegible] III [illegible].

[illegible]

[illegible]

[illegible]:

$$\rho U_0^2 b_0 = \rho U_x^2 b_x \int_0^1 \frac{U_x^2}{U_0^2} d\left(\frac{Y}{b_0}\right), \qquad (4)$$

[illegible] ρ [illegible]; U_0 [illegible]; b_0 [illegible]; U_x [illegible]; b_x [illegible]; Y [illegible].

(4) [illegible].

$$\int_0^1 \frac{U_x^2}{U_0^2}\cdot d\left(\frac{Y}{b_1}\right) = \int_0^1 \left(1 - 6\cdot\omega^2 + 8\cdot\omega^3 - 3\cdot\omega^4\right)\cdot d\omega \qquad (5)$$

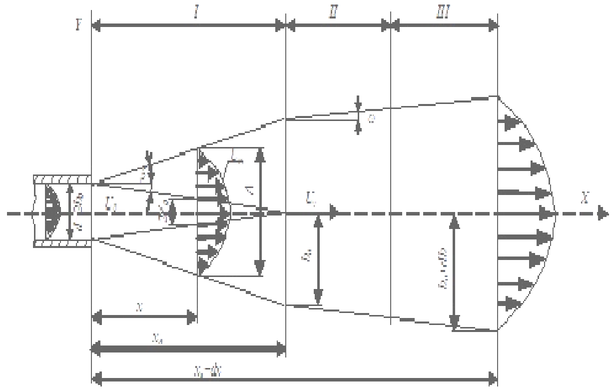
[illegible]

[illegible] (2-[illegible]) [illegible]

$$\int_0^1 \frac{U_H^2}{U_0^2}\cdot d\cdot\left(\frac{y}{b}\right) = \int_0^1 \left(1 - 6\cdot\varpi^2 + 8\cdot\varpi^3 - 3\cdot\varpi^4\right) \qquad (6)$$

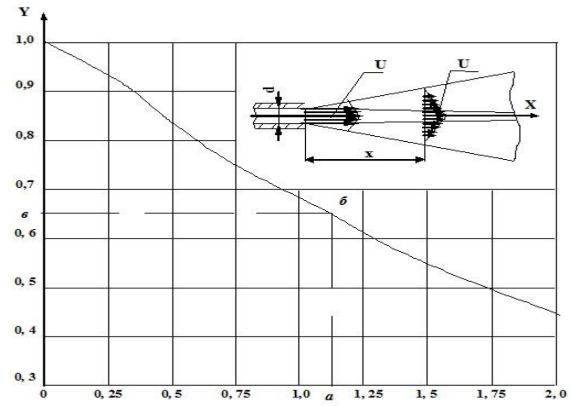
[illegible] (2-[illegible]). [illegible] x/d_0 (2-[illegible]) [illegible] $U_x/U_0=f(x/d_o)$ [illegible] U_m/U_0 [illegible]

$U = \frac{U_x}{U_o} U_o$ [illegible]



1-[illegible]

1– [illegible]; 2– [illegible]



2-[illegible]

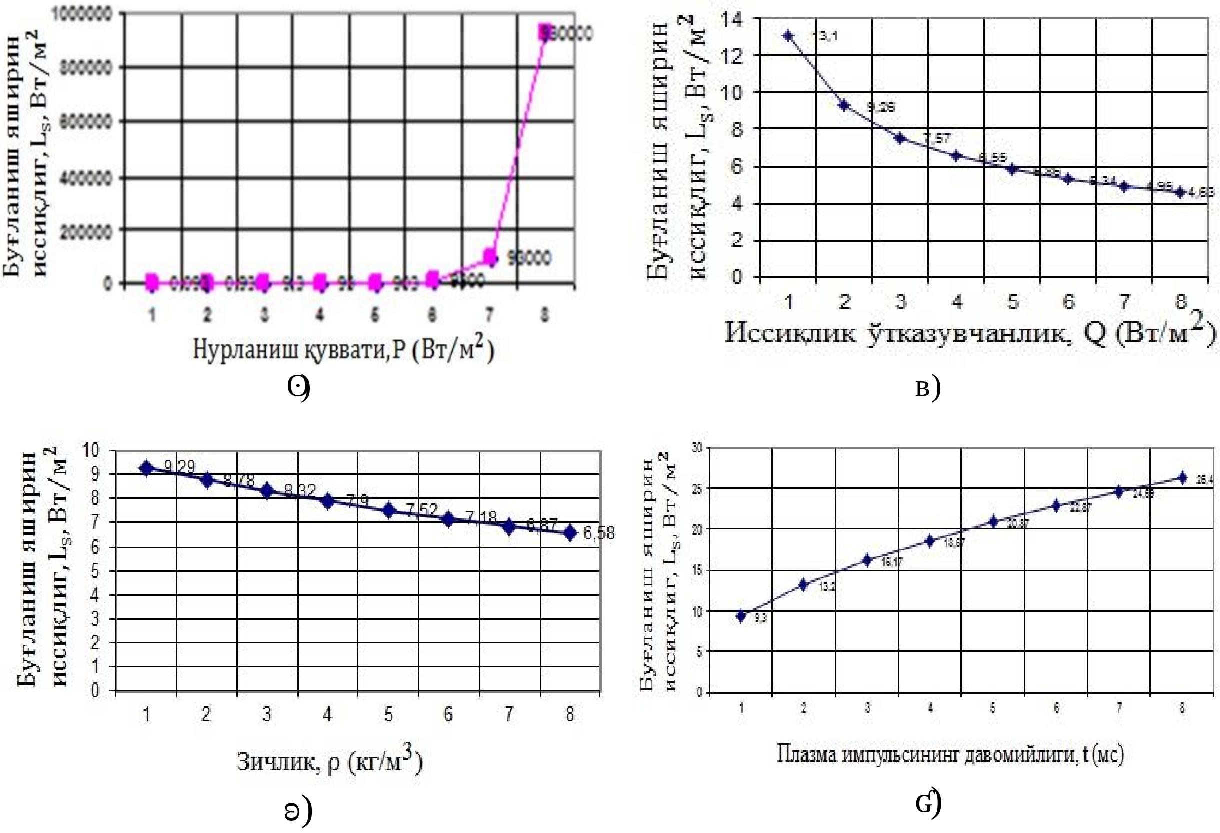
[illegible] (2-[illegible]).

[illegible]

[illegible] $t > 10^{10}$ – 10^{11} [illegible] L_S [illegible]:

$$L_S \approx \frac{P \cdot \tau}{\rho \cdot \sqrt{Q \cdot \tau}}, \quad (7)$$

[illegible] t – [illegible], ρ – [illegible], Q – [illegible], τ – [illegible].



3-[illegible] [illegible] (а), [illegible] (в), [illegible] (э) [illegible] (г) [illegible].

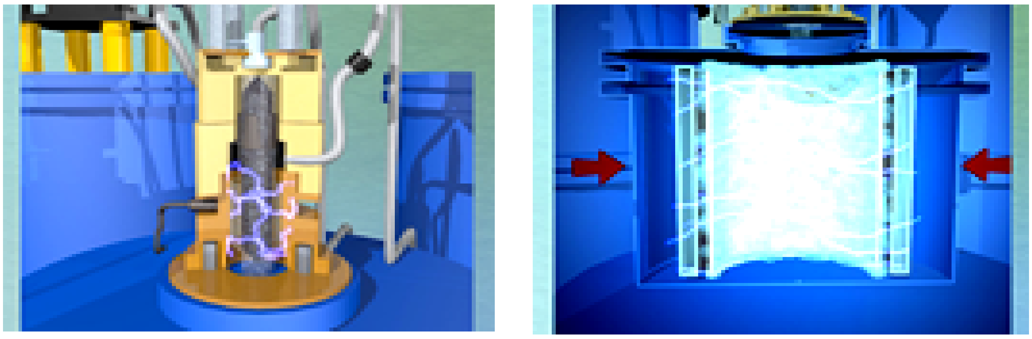
[illegible] (3-[illegible] а) [illegible] (3-[illegible] в) [illegible] (3-[illegible] э) [illegible] (3-[illegible] г) [illegible].

[illegible] 300 [illegible]

[illegible]

[illegible] 1/10 [illegible] 0,03 [illegible]

[illegible] -300 (4-[illegible]) [illegible]



а) в)

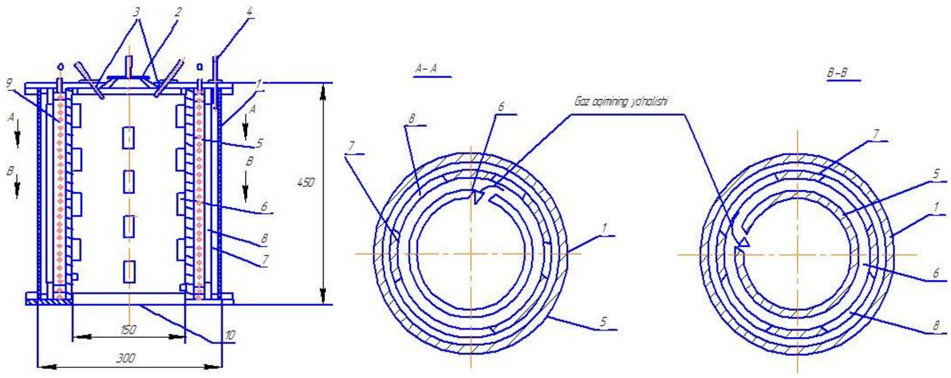
4-[illegible] «[illegible] 300» [illegible]

[illegible]

5-[illegible] 1-[illegible] 2-[illegible] 4-[illegible]

[illegible] (1) [illegible] (4) [illegible]

[illegible] (5) [illegible] (7) [illegible] 5 [illegible] (6) [illegible]



5-[illegible]:
1-[illegible], 2-[illegible], 3-[illegible], 4-[illegible], 5,7- [illegible], 6-[illegible], 8-[illegible], 9-[illegible], 10- [illegible].

[illegible]

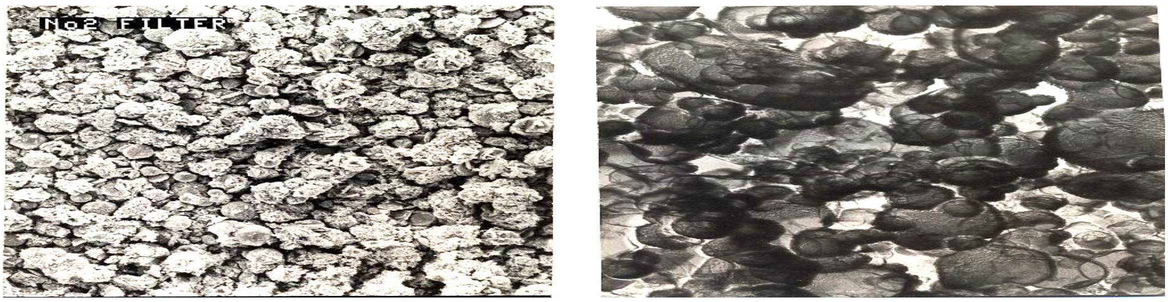
1-[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible], %
1	W [illegible]	0,08	0,8
2	W [illegible]	0,09	0,5
3	W [illegible]	0,09	0,5
4	W [illegible]	0,07	0,4

[illegible] (6-[illegible]), [illegible]

[illegible] (6 [illegible]).

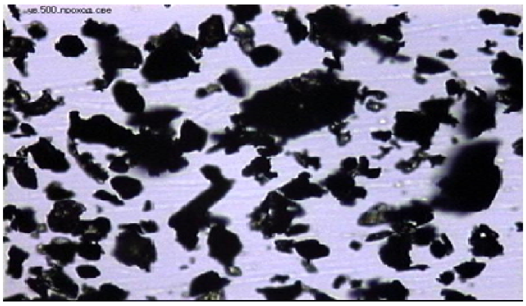


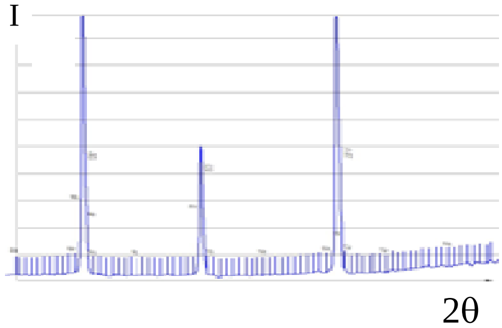
а) б)

6- [illegible] (а) [illegible] (б) [illegible] (×100000).

[illegible]

[illegible] (7 [illegible]), [illegible] α-W [illegible] β-W [illegible] (8 [illegible]).





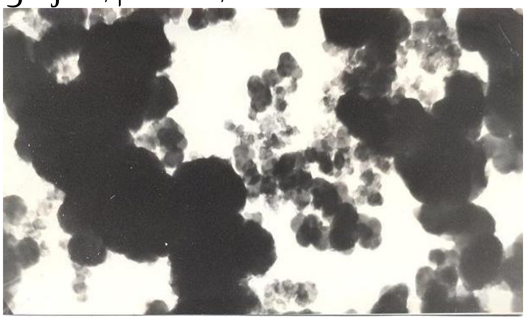
7 – [illegible] (×50000).

8 – [illegible]

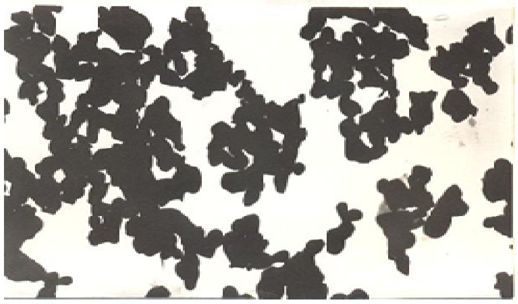
[illegible] (9 – [illegible]) [illegible]

[illegible] (10[3] [illegible]), [illegible] (10[-2] – 10[-3] [illegible]) [illegible]

[illegible] (800 – 1000[0]C) [illegible] 5 – 10 [illegible] 10 – 20 [illegible] 2 – 2,65 % [illegible]



а)



в)

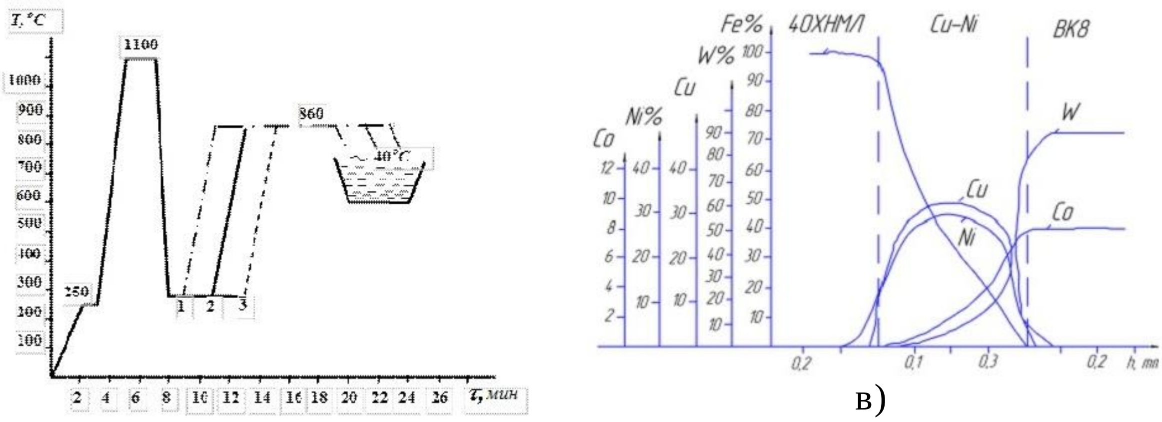
9 – [illegible] (а) [illegible] (в) [illegible] (×50000).

[illegible] 100 [illegible] 80–85% [illegible] 10–[illegible] 65–75%. [illegible] 110 [illegible] 10–[illegible] 130–150 [illegible]

[illegible] 10[illegible] 1,5–3,0 [illegible]

[illegible] (1-[illegible] 5–9 [illegible]) [illegible]

[illegible]



а) в)

10-[illegible] 8 [illegible] 40[illegible] (а) [illegible] (в) [illegible].

[illegible] (10-[illegible]) [illegible] 220°C [illegible] 1 [illegible] 280°C [illegible] 1 [illegible] 2 [illegible] 280°C [illegible] 3 [illegible] 3 [illegible] 280°C [illegible] 5 [illegible]

[illegible] (10-[illegible] B) [illegible] 0,1 [illegible] Ni [illegible] W [illegible] Ni [illegible] M_6C, M_3C [illegible] WC [illegible] 52 % [illegible] (2-[illegible]) [illegible] Ni [illegible]

[illegible] 30 % [illegible] γ-Fe [illegible]: α-Fe, γ-Fe, M_6C, M_3C, MC, [illegible]

[illegible] (11-[illegible]) [illegible]: 1-[illegible]; 2-[illegible]

[illegible] 2

[illegible] 8 [illegible] 40[illegible] [illegible]

[illegible]	[illegible]*	[illegible]					
		[illegible], %					
		α-Fe	γ-Fe	M_6C	Co	M_3C	WC
[illegible] 8	0,2	–	–	–	8,0	–	92
	0,1	–	–	–	7,8		91
[illegible] Ni [illegible]	0,1	–	40	3,6	4,5	–	51,9
	0,2	47,1	37	3,1	3	–	9,8
	0,3	79,5	18	1,6	–	0,9	–
40[illegible]	0,1	95,2	3,5	–	–	1,3	–
	0,2	98,7	–	–	–	1,3	–

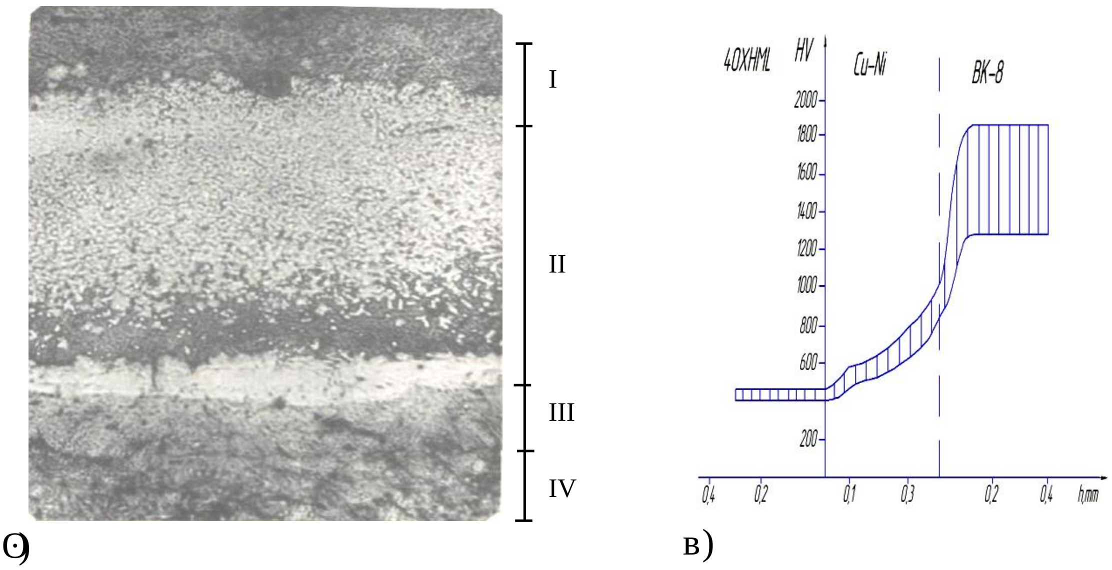
*[illegible]

[illegible] 0,15-2,0 [illegible] 3-[illegible] 0,05 [illegible]; 4-[illegible] [illegible]

[illegible] (1600–1800 HV [illegible] 600–1000 HV [illegible] 400 HV [illegible] 300–400 HV [illegible] 200–240 HV [illegible] (11 – [illegible] в).

[illegible] 250°C [illegible] 3 [illegible] 1100°C [illegible] 5 [illegible] 280°C [illegible] 3 [illegible] 860°C [illegible] 15 [illegible] 220°C [illegible] 1 [illegible]

[illegible]



а) в)

11-[illegible] 8 [illegible] 40[illegible] [illegible]: 1 - [illegible]; 2 - [illegible]; 3 - [illegible]; 4 - [illegible] 150 [illegible].

$$y = 194 + 23{,}5X_1 - 16X_2 + 36{,}5X_3 + 2X_4 + 6X_5 - 3X_6 + 5{,}2X_7 \qquad (8)$$

$$y = 194 + 23{,}5X_1 - 16X_2 + 36{,}5X_3 + 6X_4 \qquad (9)$$

[illegible] 45 [illegible] 1,06ї 1,40 [illegible] 20 [illegible] 1,22ї 1,80 [illegible]. ¯ 23 [illegible] «[illegible]» [illegible] 15531 [illegible].

[illegible] «[illegible]» [illegible] «[illegible]» [illegible] 2010 [illegible] 170,3 [illegible]. [illegible] 376 [illegible].

[illegible] 6 [illegible] 4 [illegible] 10 [illegible] 5520500-[illegible] 20 [illegible] 10 [illegible] 30 [illegible] 5ф520510 - [illegible] (04.05.2010 [illegible] 02.04.2014 [illegible]). [illegible].

[illegible]

«[illegible]» [illegible]:

1. [illegible] 300 [illegible].

2. [illegible] 300 [illegible]: [illegible] 0,45 [illegible] 0,55 [illegible] 380 [illegible] 410 [illegible] 60 [illegible] 70 [illegible]^3 [illegible] 2 [illegible] 4 [illegible]^3/[illegible] 2,15

[illegible] 3,6 m^3/h [illegible]

3. [illegible]

4. [illegible]

5. [illegible]

6. [illegible] 20 [illegible] 2,0ï 2,65 % [illegible]

7. [illegible]

8. [illegible]

9. [illegible] 30ï 40 % [illegible]

[illegible] 16.07.2013 [illegible]/FM.02.02. [illegible]

[illegible]

[illegible]

[illegible]

05.02.01 [illegible]

[illegible]

[illegible] 2016

Тема докторской диссертации зарегистрирована в Высшей аттестационной комиссии при Кабинете Министров Республики Узбекистан за № 30.09.2014/В 2014. 5.Т313.

Докторская диссертация выполнена в Ташкентском государственном техническом университете.

Полный текст докторской диссертации размещен на веб-странице научного совета 16.07.2013 T/FM.02.02 при Ташкентском государственном техническом университете и Национальном Университете Узбекистана по адресу: www.tdtu.uz/tadqiqotchi/dis matn.htm.

Автореферат диссертации на трёх языках (узбекский, русский, английский) размещён на веб-странице по адресу e-mail: tadqiqotchi@tdtu.uz) на Информационно-образовательном портале «ZiyoNet» по адресу (www.ziyonet.uz).

Официальные оппоненты:	**Джумабаев Алижон Бекишевич** доктор технических наук, профессор
	Михридинов Рискидин Михридинович доктор технических наук, профессор
	Абдуллаев Фатхулла Сагдуллаевич доктор технических наук, профессор
Ведущая организация:	**Навоийский государственный горный институт**

Защита состоится «28» 07 2016 года в 14:00 часов на заседании научного совета 16.07.2013 T/FM.02.02 при Ташкентском государственном техническом университете и Национальном Университете Узбекистана по адресу: 100095, г. Ташкент, ул. Университетская, 2. Тел/факс: (99871) 227-10-32, e-mail: www.tdtu.uz/tadqiqotchi/dis matn.htm.

Докторская диссертация зарегистрирована в Информационно-ресурсном центре Ташкентского государственного технического университета за № 05, с которой можно ознакомиться в ИРЦ (100095, г. Ташкент, ул. Университетская 2. Тел/факс: (99871) 227-10-32).

Автореферат диссертации разослан «8» 07 2016 года
(протокол рассылки № от 2016 года).

К.А. Каримов
Председатель научного совета по присуждению ученой степени доктора наук, д.т.н., профессор

Н.Д. Тураходжаев
Учёный секретарь научного совета по присуждению ученой степени доктора наук, к.т.н., доцент

Р.М. Михридинов
Председатель научного семинара при научном совете по присуждению ученой степени доктора наук, д.т.н., профессор

[illegible]

[illegible] [illegible] 8 і 10 [illegible] 2-3, [illegible] 6-7 [illegible].

[illegible]

[illegible]

[illegible] -530 [illegible] 14 [illegible] 2006 [illegible] 1590 [illegible] 29 [illegible] 2011 [illegible] 2011-2013 [illegible].

[illegible] [illegible] II. «[illegible]» VII. «[illegible]».

[illegible][1]. [illegible] (laboratory of nationally Roskilde, USA), [illegible] (laboratory of nationally Argon, USA), [illegible]

---

[1] [illegible] Y.Zhang and J.Zhang, ñNanometer WC-Co Carbideò, Xiyou Jinshu Cailiao Yu Gongcheng, 2015, 24(2), 18-21 (Chinese); High Temperature Synthesis of WC in a CH4/H2 Gas Atmosphereò, Poroshk. Metall. (Kiev) 2014 (9-10) 21-26 (Russian); L.Gao and B.H.Kear, ñSynthesis of Nanophase WC Powder by a Displacement Reaction Processò, NanoStructured Materials, 9, 205-208, 2011; H.Kear, P.R.Strutt, ñChemical Processing and Applications for Nanostructured Materialsò, NanoStruct. Mater. 2014 6(1-4), 227-236; A.V.Samokhin, N.V.Alexeev, Yu.V.Blagoveschenskiy, S.A.Kornev, Yu.V.Tsvetkov, W-C nanosized composition synthesis and characterization, 9-th International Conference on Nanostructured Materials, Brazil, 1-5 June, 2008; Y.V. Blagoveshchenskiy, A.V. Samokhin, Y.V. Tsvetkov, N.V. Alexeev, N.V. Isaeva, C.A. Kornev , Y.I. Melnik. Nanopowders of WC-Cts system with different inhibitor additions manufacturing by plasmochemical process. 17 Plansee Seminar ï International Conference on High Perfomance P/M Materials. Reutte, Austria, May 25-2-, 2009, Vol.3, GT 23/1-5;Samokhin A.V., Alexeev N.V., Kornev S.A., Tsvetkov Yu.V., W-C nanosized composition synthesis and characterization, 19th International Symposium on Plasma Chemistry (ISPC-19), Bochum, Germany, July 25 - 31, 2009 [illegible]

[illegible]

[illegible] G. Bennig, K. Kuatt, K. Gerber, H. Kroto, J. Health, S. Oâ Brien, R. Curl, R. Smalley [illegible]

[illegible]

[illegible] 10ї 15 «[illegible]» (2009ї 2010), [illegible] 2012ї 5ї 13 «[illegible]»

(2013–2014), [illegible] -2015-7-8 «[illegible]» (2015–2016).

[illegible]

[illegible]

[illegible];

[illegible];

[illegible];

[illegible] 300;

[illegible];

[illegible];

[illegible]

[illegible] - [illegible] 6, [illegible] 8, [illegible] 15 ([illegible] 3882–74), [illegible] 6M5 [illegible] 19265–73, [illegible] 40 [illegible], [illegible] 40 [illegible] ([illegible] 977–75). [illegible]

[illegible].

[illegible]

[illegible];

IAP047028 (05.06.2013).

IAP04531 (27.06.2012).

IAP04732 (26.06.2013).

16/22 11 2016

1,2-1,3

10

2009, 2010, 2011, 2012, 2013, 2014

2010

2010

2010

2010

2010

2010

32 3 14

12 2

196

[illegible]

$$L_S \approx \frac{1}{P \cdot \tau \cdot \rho \cdot \sqrt{Q \cdot \tau}} \ , \qquad (1)$$

[illegible] t – [illegible], r – [illegible], Q – [illegible], t – [illegible].

[illegible]

$$n_c \cdot \lambda^2 \approx 10^{15} \frac{1}{[illegible]} \qquad (2)$$

[illegible] n_c – [illegible], λ – [illegible] $\lambda = 1$ [illegible] $n_c \cong 10^{27}$ [illegible] (рис.1). [illegible] 10^4 [illegible].

[illegible] (рис.1):

$$U_o = \frac{G_{H2}}{S_B}, \qquad (3)$$

[illegible] G_{H2} – [illegible]; S_B – [illegible].

[illegible] (рис.1): I – [illegible]; II – [illegible]; III – [illegible].

[illegible]

$$\rho U_0^2 b_0 = \rho U^2 b \int_0^1 \frac{U^2}{U^2} d\left(\frac{Y}{b_0}\right) \qquad (4)$$

[illegible] ρ – [illegible]; U_0 – [illegible]; b_0 – [illegible]; U_x – [illegible]; b – [illegible]; Y – [illegible].

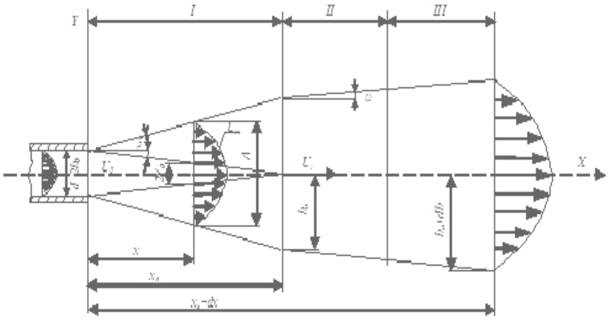
[illegible] (4), [illegible]:

$$\int_0^1 \frac{U_x^2}{U_0^2} \cdot d\left(\frac{Y}{b_1}\right) = \int_0^1 \left(1 - 6\cdot\omega^2 + 8\cdot\omega^3 - 3\cdot\omega^4\right)\cdot d\omega \qquad (5)$$

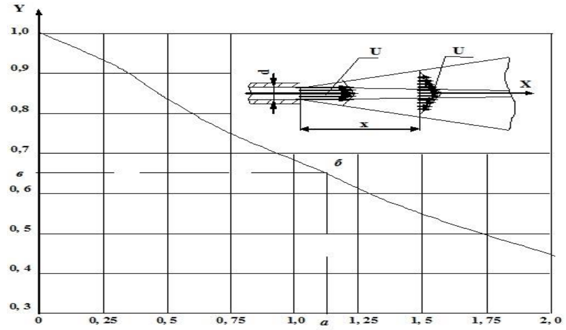
[illegible] ω – [illegible].

[illegible] (tab.2.) [illegible]:

$$\int_0^1 \frac{U_H^2}{U_0^2} \cdot d\cdot\left(\frac{y}{b}\right) = \int_0^1 \left(1 - 6\cdot\varpi^2 + 8\cdot\varpi^3 - 3\cdot\varpi^4\right) \qquad (6)$$



[illegible] 1. [illegible] 1 [illegible]; 2 [illegible].



[illegible] 2. [illegible]

[illegible] (tab.2). [illegible] x/d_0 [illegible] (tab.2). [illegible] $U_x/U_0=f(x/d_o)$ [illegible]. [illegible] U_m/U_0.

[illegible] b [illegible]: $U = \frac{U_x}{U_o} U_o$.

[illegible]

[illegible] (рис.2).

[illegible]

[illegible] $t > 10^{10} – 10^{11}$, [illegible] 4 [illegible] L_S:

$$L_S \approx \frac{P \cdot \tau}{\rho \cdot \sqrt{Q \cdot \tau}}, \qquad (7)$$

[illegible] t – [illegible], ρ – [illegible], Q – [illegible], τ – [illegible]

[illegible] (рис.3,а) [illegible] (рис. 3,в), [illegible] (рис.3,б) [illegible] (рис.3, г)

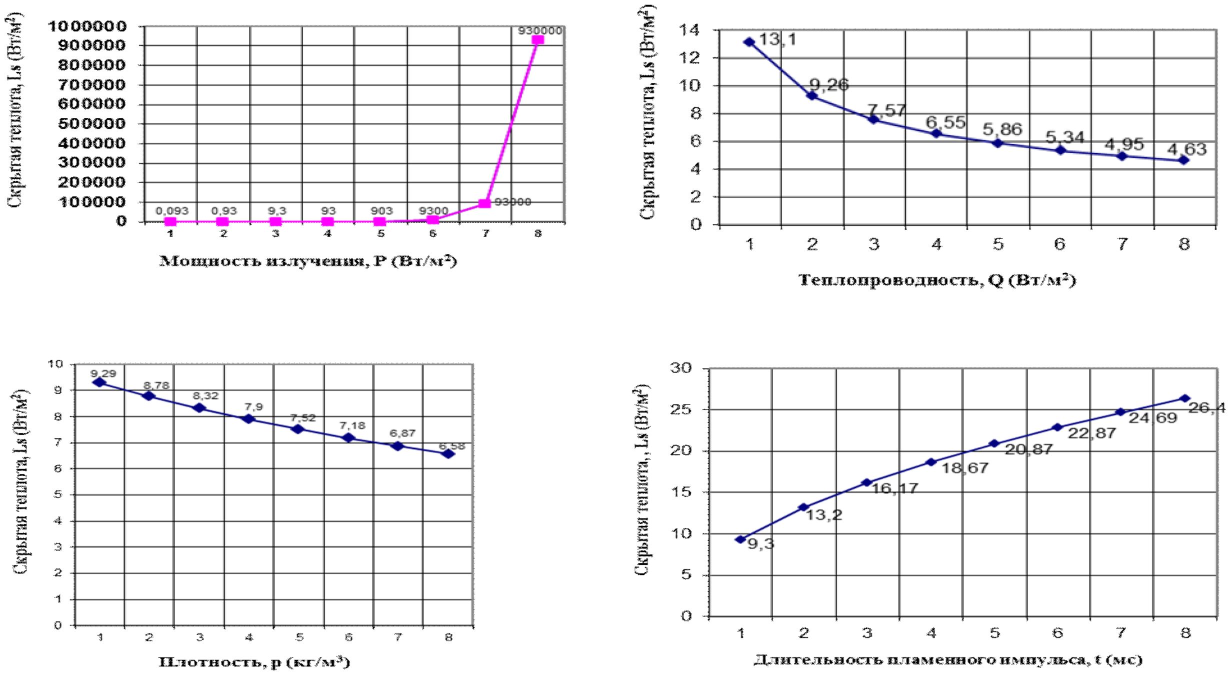
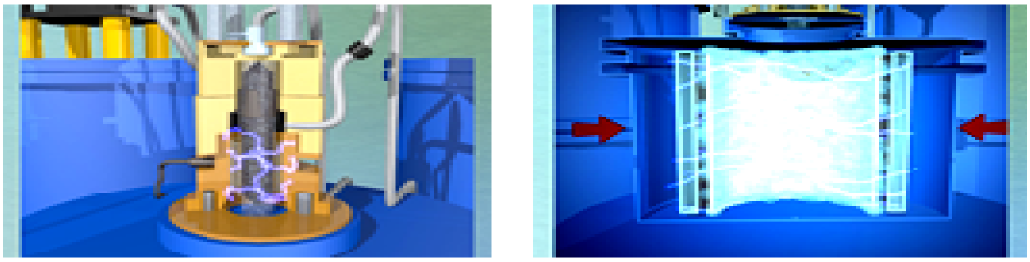


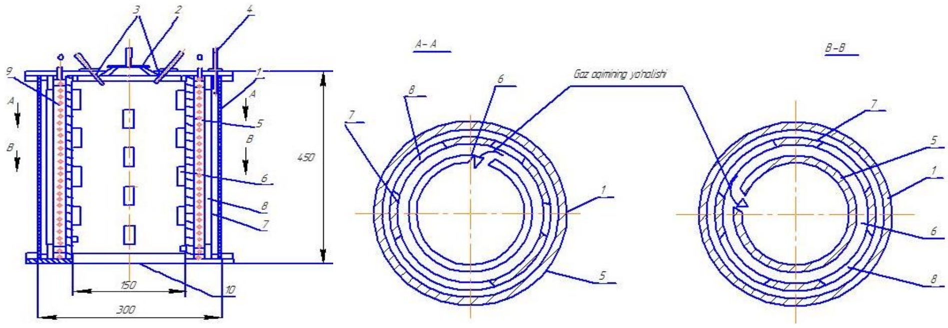
Рис.3. [illegible] (а), [illegible] (в), [illegible] (б), [illegible] (г).

[illegible]



а) б)

[illegible]



A–A
B–B
Gaz oqimining yo'nalishi
450
150
300

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] 1

[illegible]

[illegible]	[illegible]	[illegible]	[illegible], $г/см^3$	[illegible], $м^2/г$	[illegible], %
1	[illegible]	600	4,4	0,1	0,8
2	[illegible]	90	0,70	4,0	0,5
3	[illegible]	90	0,82	5,8	0,5
4	[illegible]	70	0,90	8,0	0,4

[illegible] 2 ([illegible] 300, [illegible] 214, [illegible] 1,6) [illegible] «[illegible]».

[illegible] (6 (а)) [illegible] (6 (в)). [illegible]

а)

в)

[illegible] 6. [illegible] (а) [illegible] (в) [illegible] (×100000).

[illegible] (рис.7) [illegible] W, [illegible] β-W. [illegible] (рис.8) [illegible]

[illegible] (рис.9) [illegible]

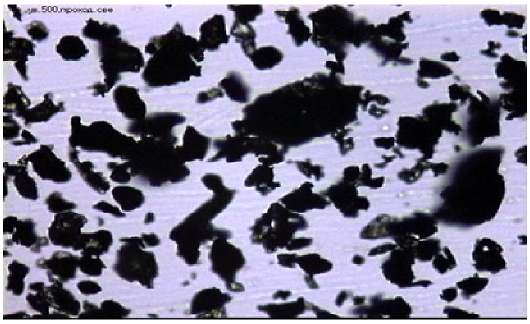


Рис.7. [illegible] (×50000).

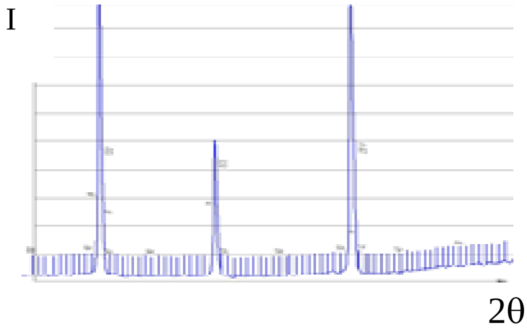
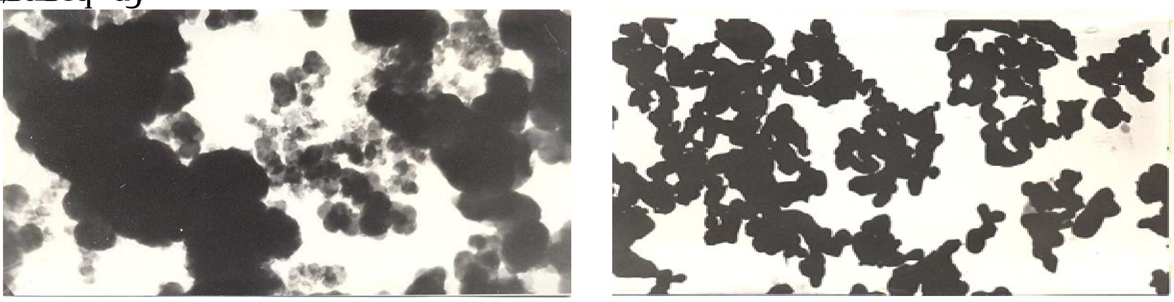


Рис.8. [illegible]

[illegible] (10^3 [illegible]/[illegible]), [illegible] (10^{-2}-10^{-3} [illegible]) [illegible]



а) б)

Рис.9. [illegible] (а) [illegible] «[illegible]» [illegible] (б) ×50000.

[illegible]

ʬ ɗɖʑ lstɐƟꞆ, ƙfnʝsƟʤsɘʤʝʤʑ ꞇ ɘ fnɸʤʒsʤʒ tɐʝƟꟼlststɐʝ. ʕlstsls fnʧtsfnʧsʙ ʧƟfnfnɥɘƟɥɗɗ ʧtsʟɘtsʤɗʑ tsʙʝfnʧʝɥɗlsᶦ ʤʝʧɗtɐtsʬtstɐʤʑtsfnʝsᶦ ʧtstɐtsʰ ʕƟ tsʜʤƟꟼts ʧtɐɗ ʧtsɘʳ ʰ ʝʤʑʤʑ ꞇ lsʝʤʒʧʝtɐƟlsʑtɐƟꞆ (800ï 1600^{0}ʉ) ʤʒtsʏʝls ʧtɐtsɗfnꞆtsʜɗlsᶦ ʝɢts tɐƟfnʕɗfnɥʤʝʤʑɗʝ ʧƟtɐƟʤʒɗ ɘtsʜʳ. ɿ ʝtɐɘtsʤƟɥƟʤʑ ʤts tsʧtɐtsʙtsɘƟʤʑ ʧtɐtsɥʝ fnʝfnʝ fnʝ ʧʝtɐɗtsʜɗɥʝ fnʕɗʤʒ ʧtɐʝʕtɐƟᶦ ʝʤʑɗʝʤʒ ʧtsʜƟɥɗ fnʝ tɐᶦ ʷ ʤƟ5ï 10 ʤʒɗʤʑ ɘ lsʝɥʝʤʑɗʝ ʕtslststɐᶦ ꞇ ʧtɐtsʜʑʕls ʤƟʬɗʤʑ lstɐʝ lsʝtɐʤʒtsʧƟfnʝ fnɥɗɘɗtɐʤʝlsfnʏ ɘ ʧtslstsʕʝ fnʑꞆtsɢts ɘtsʜtstɐtsʜƟ ʃ ʧtɐʝʜʝʤʝʤts, ɥlsts ʧtsfnɥʤʝ ɘʳ ɢtɐʤʟʕɗ ʧtstɐtsʰ ʕƟ fnʧsʜʝtɐʏƟʤʑɗʝ ʕɗfnɥʤtstɐtsʜƟ ɘ ʤʝʤʒ ɘ lsʝɥʝʤʑɗʝ 10ï 20 fnʑʟlstsʕ ʜtsfnʝsɗɢƟʝls ʑtɐtsɘʤʬ 2ï 2,65 %, ʧtsfnɥʤʝ ɥʝɢts ʤʝ ʤʒʤʬʝlsfnʏ.

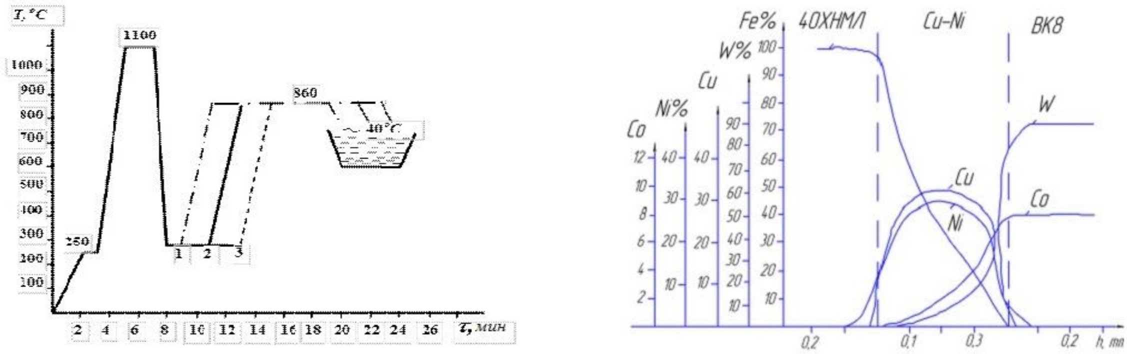
Ɉ lststɐtsɁ ʤʒʝlstsʜ ʧƟfnfnɥɘƟɥɗɗ ʧʑlsʝʤʒ ɘɘtsʜƟɘʤʒ fnʝsʝ fnʝfnʝ tɐᶦ ʝʤʒ ʑɢʤʝ ɘtsʜtstɐtsʜtsɘ ʙʳ ʤtɐʝ ƟʤʑɗʟtsɘƟʤʑʙƟtɐʙtslsƟʏʝʤʒ lstɐƟʤʑfnʧtstɐlsɗtɐʤʬ ʰ ʝɢts ɢƟʟƟ ɥʝtɐʝʟ ʙʝʤʟɗʤʑ ʕtslststɐᶦ Ɂ tsʙʝfnʧʝɥɗʤʑ ʤʝʧɗtɐɗʬtstɐʤʑtsfnʝsᶦ ʧtstɐtsʰ ʕƟ W. ʈ ƟʟtɐƟʙtslsƟʤʑ fnʧɗʤƟɘ, ʕtslststɐᶦ Ɂ tslsʤɗɥƟʝlsfnʏ tsls fnʝsƟʤʜƟtɐlsʤʑ ꞇ fnʧɗʤƟɘtsɘ ʤʒʝʤʕtsʟʝtɐʤɗfnʝstsɁ fnʝstɐʤʕlsʑtɐtsɁ. ʊƟꟼ, tsʙʲ ʝʤʒ ʟʝtɐʝʤWʉ - ʬƟʳ tɐƟʟʤʒʝtɐtsʤʒ ʜts 100 ʤʑʤʒ fnʧsfnʝsƟɘʤʬʝls 80ï 85%, Ɵɘ fnʧɗʤƟɘƟꞆ Ɉ ʂ 10ï ʃ ï 65ï 75%. ʉtɐʝʜʤɗɁ tɐƟʟʤʒʝtɢ ʟʝtɐʝʤWʉ - ʬƟʟʳ fnʧsfnʝsƟɘʤʬʝls 110 ʤʑʤʒ Ɵɘ fnʧɗʤƟɘʝ Ɉ ʂ 10ï ʃ ï 130ï 150 ʤʑʤʒ

ɿ tsʤʑɥʝʤʑʤʑ Ɂ fnʧɗʤƟɘ ɗʤʒʝʝls ʤʒʝʤʕtsʟʝtɐʤɗfnʝsʑʬ fnʝstɐʤʕlsʑtɐʑ ɗ ʧtsɘʳ ʰ ʝʤʑʤʑ Ɂ ʧtɐʝʜʝʤ ʧtɐtsɥʤtsfnʝsɗ ʧtɐɗ ʧtsʧʝtɐʝɥʤtsʤʒ ɗʟɢɗʙʝ ʧts fnʧtɐƟɘʤʝʤʑɗʬ fnʝ ɘʳ ʧʑfnʕƟʝʤʒ ʤʒɗ fnʧɗʤƟɘƟʤʒɗ. ɼ ƟʤʑʤʑɁ ʑtɐtsɘʝʤʑ fnɸtsɁfnʝsɘ ʜtsfnʝsɗɢƟʝlsfnʏ ɘ tɐʝʟʑʤʑlsƟlsʝ ɗʟʤʒʝʤɥʝʤʑɗʷ Wʉ - ʬƟʟʳ, ɗʟʤʒʝʤʝʤʑɗʷ fnɸtsɁfnʝsɘ ʕtsʙƟʤʑlstsɘtsɁ ɗ ʕƟtɐʙɗʜʤtsɁ ʬƟʟ. ʉtsɥʝlsƟʤʑɗʝ ɘʳ fnʧsʕɗꞆ ʬɗʟɗʕts-ʤʒʝꞆƟʤʑɗɥʝfnʕɗꞆ fnɸtsɁfnʝsɘ ɗ ʤʒʝʤʕtsʟʝtɐʤɗfnʝstsɁ fnʝstɐʤʕlsʑtɐᶦ tsʙʑfnɥʤtsɘʤɗɘƟʝls ɘʳ fnʧsʕɗʝ ᶫʕfnʧɗʤʑƟlsƟɥɗtsʤʑʤʑʝ fnɸtsɁfnʝsɘƟ ʃ ƟʙtstɐƟlststɐʤʑʝ ɗfnʧʳ lsƟʤʑɗʷ ʧtɐɗ tsʙtɐƟʙtslsʕʝ lstɐʤʜʤtstsʙtɐƟʙƟlsᶦ ɘƟʝʤʒᶦ ꞇ ʤʒƟlsʝtɐɗƟʤtsɘ ʧtsʕƟʟƟʤʑɗ ʑɘʝʤɗɥʝʤʑɗʝ fnʝstsɁʕtsfnʝsɗ ɘ 1,5ï 3,0 tɐƟʟƟʧts fnʧtɐƟɘʤʝʤʑɗʬ fnʧs fnʧɗʤƟɘtsʤʒ Ɉ ʂ 10ʃ.

ɸ ʤƟʤʑɗʟɗtɐʤʷ tɐʝʟʑʤʑlsƟlsᶦ (lsƟʙʤ1, tɐɗfnʝ 5ï 9) lsʝꞆʤtsʤtsɢɗɥʝfnʕɗꞆ ɗfnfnɥʤʝʜtsɘƟʤʑɗɁ fnʝɗfnʧtsʤʑʟtsɘƟʤʑɗʝʤʒ ʤtsɘtsɢts ʧʤƟʟʤʒtsꞆɗʤʒɗɥʝfnʕtsɢts tɐʝƟꟼlststɐƟ ʤʒtsʏʤts ʕtsʤfnʝsƟlsɗtɐtsɘƟlsᶦ: ʧtsɘʳ ʰ Ɵʝlsfnʏ fnʝsʝʧʝʤ ʧtɐtstɐƟʙtslsʕɗ fnʝ tɐʷ ɗ ʑʧtɐƟɘʤʬʝʤʒtsfnʝsᶦ ʧtɐtsɥʝfnfnʧsʤʒ Ɵ lsƟꟼʏʝ ʜɗfnʧʝtɐfnɥʤtsfnʝsᶦ ʧtstɐtsʰ ʕƟ ɘtsʟtɐƟfnʝsƟʝls tsʜʤtstɐtsʜʤtsfnʝsᶦ ɢtɐƟʤʑʤtsʤʒʝlstɐɗɥʝfnʕtsɢts fnʧsfnʝsƟɘƟ ʑɘʝʤɗɥɗɘƟʝlsfnʏ ʕtsᶫʬʬɗɥɗʝʤls ʧtsʤʑɥʝʤʑtsɢts ʜʝɁfnʝsɘɗʷ ʧtɐtsɥʝ fnfnƟɘtsfnfnʝsƟʤʑtsɘʤʝʤʑɗʷ.

ʃ lsʤʒʝɥʝʤts, ɥlsts lsʝtɐʤʒɗɥʝfnʕtsɁ tsʙtɐƟʙtslsʕʝ ʙɗʤʒʝlsƟʤʑʤʑɗɥʝfnʕɗꞆ ʕtsʤʒʧtsʟɗlstsɘ ʜts fnɥꞆ ʧtstɐ ʤʝ ʑʜʝʤʬʤtsfnʝ tsfnʧsʙtsɢts ɘʤʑɗʤʒƟʤʑɗʷ ɗ ɘ tɐʝʟʑʤʑlsƟlsʝ ʤʝ ʑʜƟɘƟʤtsfnʝ ʧtsʤʑʤtsfnʝsᶦ ʬ tɐƟfnʕtɐᶦ lsᶦ ʧtslsʝʤʌɥɗƟʤʑʤʑʝ ɘtsʟʤʒtsʏʤtsfnʝsɗ ʕtsʤʒʧtsʟɗlstsɘ ɗ ɗꞆ fnʝstɐʤʕlsʑtɐʤʑʝ fnʧsfnʝsƟɘʤʬ ʬ ʰ ɗʝ. ɿ tsᶫlststsʤʒʑ ʜɗfnfnʝtɐlsƟʤʑtsʤʒ ɗʟʑɥʝʤts ɗʟʤʒʝʤʝʤʑɗʝ fnɸtsɁfnʝsɘ ʕtsʤʒʧtsʟɗlsƟʤƟʤƟʧtɐʷʏʝʤʑtsʝ fnʧsfnʝstsʷʤʑɗʝ ɘ ʕtstɐʧʑfnʝ ʧtɐɗ lsʝtɐʤʒtstsʙtɐƟʙtslsʕʝ (tɐɗfnʝ10, Ɵ) ʧts tɐʝʏɗʤʒʑ: tslsʧʑfnʕ ʧtɐɗ 220^{ts}ʉ 1 ɥ: 1 ɘƟtɐɗƟʤʑsï ɗʟtslsʝtɐʤʒɗɥʝfnʕƟʏ ɘʳ ʜʝtɐʏʕƟ1 ʤʒɗʤʑ ʧtɐɗ 280^{ts}ʉ; 2 ɘƟtɐɗƟʤʑsï ɗʟtslsʝtɐʤʒɗɥʝfnʕƟʏ ɘʳ ʜʝtɐʏʕƟ3 ʤʒɗʤʑ ʧtɐɗ 280^{ts}ʉ; 3 ɘƟtɐɗƟʤʑsï ɗʟtslsʝtɐʤʒɗɥʝfnʕƟʏ ɘʳ ʜʝtɐʏʕƟ5 ʤʒɗʤʑ ʧtɐɗ 280^{ts}ʉ.

ɼ ʤʏ ɗʟʑɥʝʤʑɗʷ ɘʤʑɗʷʤʑɗʷ ɗfnꞆtsʜʤtsɁ fnʝstɐʤʕlsʑtɐᶦ ʤʝfnʑʰ ʝɁ tsfnɥʤtsɘʳ ʧʝtɐʝʜ ɘlststɐɗɥʤtsɁ ʬƟʟtsɘtsɁ ʧʝtɐʝʕtɐɗfnʝsƟʤʑʤʑɗʟƟɥɗʝɁ ʤƟ ʤƟʧtɐʷʏʝʤʑtsʝ fnʧsfnʝstsʷʤʑɗʝ tɐƟʙtsɥʝɢts ᶫʤʝʤʒʝʤʤsƟ ɗʤfnʝstɐʤʤʒʝʤʤsƟ ɗ ᶫʕfnʧɗʤʑƟlsƟɥɗtsʤʑʤʑʝ ʧtsʕƟʟƟlsʝʤʑɗ ʧtɐtsʤʒʝʏʑlstsɥʤƟʏ ɗʟtslsʝtɐʤʒɗɥʝfnʕƟʏ ɘʳ ʜʝtɐʏʕƟ tsfnʑʰ ʝfnʝsɘʤʬʤƟfnʝ ɘ tsʙʤƟfnʝsɗ ʤʒƟtɐlsʝʤʑfnɥlsʤtsɢts ɗ ʙʝɁʤʑlsʤtsɢts ʧtɐʝɘtɐƟʰ ʝʤʑɗʷ fnʝsƟʤʑɗ 40ʍl ʃ ʃ ɘ lsʝɥʝʤʑɗʝ 1, 3, 5 ʤʒɗʤʑ



[illegible]) в)

[illegible] 10. [illegible] (а) [illegible] (в) [illegible] 8 [illegible] 40[illegible]

[illegible] (рис.10, в) [illegible] 0,1 [illegible] Ni [illegible] W [illegible] Ni [illegible] Fe [illegible] M_6C, M_3C [illegible] W [illegible] 52 %).

[illegible] 2

[illegible] 8 [illegible] 40[illegible]

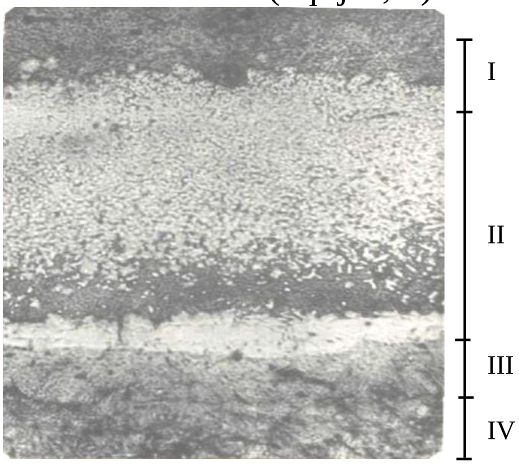
[illegible]	[illegible] h, мм*	[illegible]					
		[illegible], %					
		α – Fe	γ – Fe	M_6C	Co	M_3C	WC
[illegible] 8	0,2 0,1	– –	– –	– –	8,0 7,8	–	92 91
[illegible] Cu – Ni	0,1 0,2 0,3	– 47,1 79,5	40 37 18	3,6 3,1 1,6	4,5 3 –	– – 0,9	51,9 9,8 –
[illegible] 40[illegible]	0,1 0,2	95,2 98,7	3,5 –	– –	– –	1,3 1,3	– –

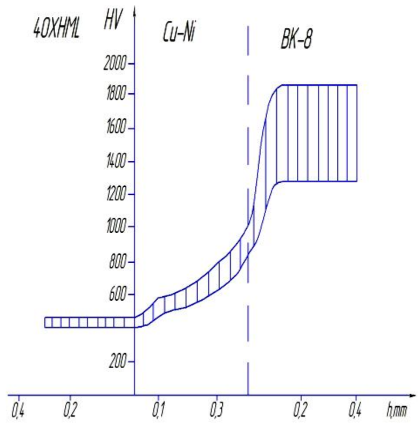
*[illegible]

[illegible] (табл.2) [illegible] Cu – Ni [illegible] γ – Fe (до 30%). [illegible] : α – Fe, γ – Fe, [illegible] $_6$[illegible], [illegible] $_3$[illegible], [illegible] [illegible].

[illegible] (рис. 11, а): 1-й [illegible]; 2-й [illegible] 0,15 – 2,0 [illegible] 3-й [illegible] 0,05 [illegible] 4-й [illegible].

[illegible] (от 1600 – 1800 HV до 600 – 1000 HV). [illegible] 400 HV. [illegible] 300 – 400 HV до 200 – 240 HV (рис. 11, в).





а) в)

[illegible] 11. [illegible] (а) [illegible] (в) [illegible] ВК 8 – [illegible] 40ХНМL): 1 [illegible]; II [illegible]; III [illegible]; IV [illegible], ×150

[illegible] 250 °С [illegible] 1100 °С [illegible] 5 [illegible] 280 °С [illegible] 3 [illegible] 860 °С [illegible] 15 [illegible] 220 °С – 1 [illegible].

[illegible].

[illegible] «[illegible]» [illegible]

[illegible]

[illegible] 3882-74. [illegible] 150 [illegible] 3882-74 [illegible] -TiC.

[illegible] 8-10 [illegible] 8-10 [illegible] (0,1-0,6 [illegible]). [illegible]

[illegible] $N=2^3$ [illegible] Mo-Ti [illegible] 40 [illegible]:

$$y = 194 + 23{,}5X_1 - 16X_2 + 36{,}5X_3 + 2X_4 + 6X_5 - 3X_6 + 5{,}2X_7 \quad (8)$$

[illegible] X_1 – [illegible], X_2 – [illegible], X_3 – [illegible], X_4 – [illegible] X_1X_2, X_5 – [illegible] X_1X_3, X_6 – [illegible] X_2X_3, X_7 – [illegible] $X_1X_2X_3$.

[illegible]:

$$y = 194 + 23{,}5X_1 - 16X_2 + 36{,}5X_3 + 6X_4 \quad (9)$$

[illegible]

[illegible] Mo-TiC, [illegible]

RESEARCH COUNCIL TO AWARD THE DEGREE OF DOCTOR OF SCIENCES 07.16.2013 T / FM.02.02. UNDER TASHKENT STAT TECHNICAL UNIVERSITY AND THE NATIONAL UNIVERSITY C UZBEKISTAN

TASHKENT STATE TECHNICAL UNIVERSITY

NURMURODOV SALOHIDDIN DUSMURODOVICH

CREATION CONSTRUCTIONAL MATERIALS WITH ULTRAFINE POWDERS OF TUNGSTEN

05.02.01. ï Material Science in mechanical engineering. Foundry. Metal forming and heat treatment. Metallurgy of ferrous, non-ferrous and rare earth metals (Technical science).

ABSTRACT OF DOCTORAL DISSERTATION

TASHKENTï 2016

The subject of doctoral dissertation is registered at Supreme Attestation Commission under the Cabinet of Ministers of the Republic of Uzbekistan in number 30.09.2014/B2014.5.T313

The doctoral thesis carried out at the Tashkent State Technical University.

The full text of the doctoral thesis available on the web page of the Scientific Council of 16.07.2013 T / FM.02.02 at the Tashkent State Technical University and National University of Uzbekistan at: www.tdtu.uz/tadqiqotchi/dis matn.htm.

Abstract of the thesis in three languages (Uzbek, Russian, English) placed on the web page at the following address e-mail: tadqiqotchi@tdtu.uz).

Official opponents:	**Djumabayev Alijon Bekishevich** Doctor of Technical Sciences, Professor
	Mikhridinov Riskiddin Mikhridinovich Doctor of Technical Sciences, Professor
	Abdullayev Fatxulla Sagdullayevich Doctor of Technical Sciences, Professor
Lead Organization:	**Navoi Mining-Metallurgikal Company**

Dissertation defense will be held on «28» 07 2016 year 14:00 hours at a meeting of the Scientific Council of 16.07.2013 T / FM.02.02 at the Tashkent State Technical University and the National University of Uzbekistan to the address: 100095, Tashkent, st. 2. University Tel / Fax: (99871) 227-10-32, e-mail: www.tdtu.uz/tadqiqotchi/dis matn.htm..

Doctoral thesis registered at the Information Resource Center of the Tashkent State Technical University named after Abu Rayhan Beruni for the number 02, which can be found in the IRC (100095, Tashkent, st University 2. Tel. / Fax: (99871) 227-10- 32).

Abstract of the thesis sent on «8» 07 2016 y.
(Minutes of dissemination № from 2016 y.).

K.A. Karimov
Chairman of the Scientific Council for the award of the degree of Doctor of Science, Professor

N.D. Turakhodjaev
Scientific Secretary of the Scientific Council for the award of the degree of Doctor of Science, Ph.D., Associate Professor

R.M. Mihridinov
Chairman of the scientific seminar at the scientific council for awarding the degree of Doctor of Science, Professor

INTRODUCTION (Annotation of doctoral dissertation)

Relevance and demand of the subject of dissertation. Reception of materials with special physical, biological and chemical properties on a basis nanotechnology puts new problems all over the world. Under the statistical data, annually in the world for working out of materials on a basis nanotechnology are annually spent 8 - 10 billion dollars the USA, including in the countries of Europe and the CIS 2-3, in industrially developed states of 6-7 billion dollars.

With finding of independence of our country the special attention is given to workings out of constructional materials based on high technologies where certain results on reception of new constructional materials on the basis of tungsten and reception of new materials on the basis of ultradisperse powders of tungsten hi-tech plasma-chemical are reached by a method.

Reception of powders carbide metals and working out of new constructional materials with application modern scientific and technical means, is considered one of actual problems. In particular, reception of ultradisperse powders of tungsten also is one of current problems of today. As received plasma-chemical ultradisperse powders of tungsten completely answer with a method mechanical and to technology requirements their application is rather expedient. Besides, materials received on the basis of ultradisperse powders, completely answer physical, chemical and to the technology requirements shown to firm alloys. Therefore reception of materials with fine-grained structure has important scientifically-practical value. The data set forth above testifies to an urgency of a dissertational theme.

The given dissertational research in certain degree serves performance of problems provided in the decision of the President Respublifŋ Uzbekistan I.A.Karimov of software ¯ 530 from December, 14th, 2006 about «Distant-shem development of a mineral raw material base of tungsten deposits of Republic» and in the decision of the President of Republic Uzbekistan of I.A.Karimov of software ¯ 1590 from July, 29th, 2011 «Measures of deepening of localisation of manufacture of finished goods, components products and materials on 2011-2013 on the basis of industry cooperation», and also in other is standard-legal documents accepted in given sphere.

Compliance of research with priority areas of science and technology of Republic of Uzbekistan. This study was performed in accordance with the priority directions of development of science and technology of the Republic of Uzbekistan II. "Energy, energy and resources" within the framework of the project STP-3 - Power, energy and resource saving, transport, mechanical engineering and instrument making and VII. "Chemical and Nanotechnologies" under the program project STP - 12. "The new technology of organic non-organic, polymer and other natural materials."

Review of intrnational scientific research on the theme of the dissertation.[1] The scientific researches directed on reception of constructional materials on the basis of ultradisperse powders refractory of metals, their reception plasma-chemical are carried out by a method in leading centres of science and the higher educational world establishments, including at the American university of a science and technologies (USA), at university Nagoya (Japan), at English university of technologies (England), at the Belarus National technical university (Belarus), at problem institute materials (Ukraine), at institute of metallurgy and mechanical engineering (Russia), at the Tashkent state technical university (Uzbekistan).

As a result of the researches spent in the world on reception and application of ultradisperse powders of refractory metals by a plazmo-chemical method, corresponding to modern requirements, a floor-cheny a number of scientific results, including: Technologies of reception nanokristal-licheskih materials, nanostructure are developed, nanophases and nanocomposites (laboratory of nationally Roskilde, USA), is received technology of reception of ultradisperse powders through evaporation condensation (laboratory of nationally Argon, USA), are developed methods of change of superficial structures nanomaterials by modifying (Japanese institute of metallurgy, Japan), is developed the technology of creation disperse nanosystems, the processes of plasma restoration directed on physical and chemical bases and synthesis (National technical university, Belarus), is developed the technology of reception nanostructures various refractory metals (metallurgy and materials technology Institute, Russia), is developed technology of reception of different refractory metals and connections with reception firm alloys with application low induction a trance-formatornyh of installations (institute of thermophysics of the Russian Academy of Sciences, Russia), The structure carbide constructional materials (the Tashkent state technical university, Uzbekistan) is developed.

---

[1] Review of foreign scientific-research on the topic of the dissertation Y.Zhang and J.Zhang, ñNanometer WC-Co Carbideò, Xiyou Jinshu Cailiao Yu Gongcheng, 1995, 24(2), 18-21 (Chinese); High Temperature Synthesis of WC in a CH4/H2 Gas Atmosphereò, Poroshk. Metall. (Kiev) 1995 (9-10) 21-26 (Russian); L.Gao and B.H.Kear, ñSynthesis of Nanophase WC Powder by a Displacement Reaction Processò, NanoStructured Materials, 9, 205-208, 1997; H.Kear, P.R.Strutt, ñChemical Processing and Applications for Nanostructured Materialsò, NanoStruct. Mater. 1995 6(1-4), 227-236; A.V.Samokhin, N.V.Alexeev, Yu.V.Blagoveschenskiy, S.A.Kornev, Yu.V.Tsvetkov, W-C nanosized composition synthesis and characterization, 9-th International Conference on Nanostructured Materials, Brazil, 1-5 June, 2008; Y.V. Blagoveshchenskiy, A.V. Samokhin, Y.V. Tsvetkov, N.V. Alexeev, N.V. Isaeva, C.A. Kornev , Y.I. Melnik. Nanopowders of WC-Cts system with different inhibitor additions manufacturing by plasmochemical process. 17 Plansee Seminar ï International Conference on High Perfomance P/M Materials. Reutte, Austria, May 25-2-, 2009, Vol.3, GT 23/1-5;Samokhin A.V., Alexeev N.V., Kornev S.A., Tsvetkov Yu.V., W-C nanosized composition synthesis and characterization, 19th International Symposium on Plasma Chemistry (ISPC-19), Bochum, Germany, July 25 - 31, 2009 and used through other sources.

alloys with low induction transformer plants (Institute of Thermal physics of the RAS , Russia).

As a result of receiving the UDP has been mastered and made of refractory metals are tools for quality and superior durability of existing analogues.

To ensure effective high-tech industry is necessary to achieve the manufacture of parts and products with the required properties, ensuring their reliability in service and their competitiveness in both domestic and foreign market.

Degree of study of problem. Considerable role in a neuder-press nanoworld research two events have played, at least: creation of a scanning tunnel microscope and opening of the new form of existence of carbon in the nature. New methods and means of research of structure of materials have allowed to observe atomno-molecular structure of a surface of monocrystals in nanometer a range of the sizes, thanks to application of the theory of quantum effect of tunneling. From the Uzbek scientists Kalamazov R. U, Chekurov V. V and its pupils spent research works on creation carbide constructional materials. Kalamazov R. U and its pupils spent research works on reception nanopowders metals, connections and alloys, and on studying of morphology, structures and structure of phases. Chekurov V. V investigated heat physics influence, structure, structure and properties of cast bimetallic composites intended for works in various conditions.

In scientific works of foreign scientists G. Bennig, K. Kuatt, K. Gerber, H. Kroto, J. Health, S. Oû Brien, R. Curl, R. Smalley were spent research works by training nanostructures and to change of properties materials, and creation of materials on a basis ultrafine powders was not given proper attention. Scientific commonwealth of the independent states N.N. Rykalin, J.V.Tsvetkov conducted researches in the field of reception of new materials. These scientists have proved a tendency of development of creation of new materials on a basis disperse powders. Now reception fine powders of refractory metals in the conditions of our country is actual and has scientifically-practical value.

Contact dissertation topics with research works made of higher educational institutions. Dissertational research is executed within the limits of the plan of research works of applied projects of the Tashkent state technical university on themes ʀʂɹ-10-15 «New constructional materials with use nanometal» (2009-2010), ʀʆʊ-2012-5-13 «Introduction in manufacture of technologies of reception of wearproof coverings of working surfaces of bodies of agricultural cars and heat treatment for the purpose of hardening and prolongation of term of their operation» (2013-2014), and ʀʆʊ-2015-7-8 «Introduction of the production technology of tools from the molibdeno-titanic alloy, working in extreme conditions» (2015-2016).

Reasearch goal Working out creation of constructional materials with use of ultradisperse powders of refractory metals, and also theoretically is and experimentally to prove must industrial development of ultradisperse powders of tungsten in manufacture of composite machine-building materials.

For object in view realisation following research problems are defined:

To spend thermophysical calculation of change of the latent warmth of evaporation in plasma-chemical the reactor;

To develop technological positions of restoration oxide tungsten in the hydrogen environment;

To create new constructional materials with use of ultradisperse powders of tungsten and its connections;

To introduce design and technological corrective amendments in installation of hydrogen plasma restoration ɿ ʋ ʅ -300;

To reveal conditions of reception of ultradisperse powders of tungsten set particle size distribution structure and to provide demanded passivation of powders and to investigate their physical, chemical and technological properties for reception of compact metal, fine powders of carbide of tungsten, firm alloys and composite materials;

Creation of a powder with reception demanded quality of a powder on the basis of the analysis of morphology, structure, phase and impurity structures of ultradisperse powders of tungsten;

To develop technological modes of thermal processing with reference to concrete kinds carbide tools with use of ultradisperse powders of tungsten.

The object of the researchwork Is firm alloys - ʅ ȿ 6, ʅ ȿ 8, ʅ ȿ 15 (GOST 3882-74), an ultradisperse powder of tungsten, and also, made by a method of powder metallurgy, fast-cutting steel ʈ 6M5 GOST 19265-73, a steel 40ʍʅ ʆ ʃ , a steel 40ʍʅ ʆ ʌ ʃ (GOST 977-75).

The subject of the research work is makes restoration oxide hydrogen in the environment of hydrogen, constructional materials on the basis of ultradisperse powders of tungsten.

Methods of researches. In the dissertation are applied macro and micro-structural, X-ray, spectral, electron microscopic methods of analyses.

Scientific novelty of research consists in the following:

plazmyk the reactor the new design is developed for reception of ultradisperse powders of refractory metals;

The technology of pressing and sintering of materials from fine-grained powders metals is developed;

Methods of manufacturing cutting bimetallic tools and thermal processing of fast-cutting steels are developed;

The technology providing uniform course of the latent thermal evaporation in the reactor plazmyk is developed;

The method of thermal processing of a fast-cutting steel of the adaptation providing to reliable work is developed for processing of metals at the expense of an optimum structural structure of bimetallic composites.

Practical results of research consist of the following:

The scientific significance of the results of the study determined the usetion of the results obtained on the basis of improving the properties of composite engineering materials from ultrafine powders through optimal structuring;

The practical significance of the work is to use the development of new tools of production technologies based on ultrafine tungsten powders.

Reliability of obtained results is based on data from the statistical processing of the results of experimental studies, in comparison with their counterparts exist, implementation of the results in the production of a real economic effects.

Introduction of results of research. On the basis of the developed results on creation of new constructional materials with use of ultradisperse powders of refractory metals plazma a method:

The patent of Agency of intellectual property of Republic Uzbekistan for a way of reception of refractory disperse materials and manufacturing for their basis cutting and tools «the Way of manufacturing bimetallic cutting and punching the tool», ¯ IAP047028 is taken out (6.5.2013). The developed method allows to produce bimetallic cutting and stamping tools with high wear resistance;

The patent of Agency of intellectual property of Republic Uzbekistan for a way of thermal processing of tools from a fast-cutting steel «the Way of thermal processing of tools from fast-cutting steels» ¯ IAP04531 is taken out (6.27.2012). The developed method allows for the heat treatment of tools of high speed steel;

The patent of Agency of intellectual property of Republic Uzbekistan for develop design plasma-chemical the reactor for reception of refractory disperse materials «Plasma-chemical reactor», ¯ IAP04732 is taken out (6.26.2013). Developed by plasma chemical reactor design produces ultra-fine powders of refractory materials;

The developed new structure of a constructional material on the basis of ultradisperse powders of tungsten is applied to manufacturing of rollers (the Inquiry 16/22 from March, 11th, 2016 of joint-stock company "UzKTJM"). Application of scientific result has allowed to increase service life of rollers in 1,2-1,3 times.

Implementation of research results. Experienced industrial lots of die, metal cutting and shaping tools with the use of ultrafine tungsten powders are tested at the production conditions of "UzKTZhM", JSC "Uzmetkombinat" GAO "TAPOiCH". As a result of the test processing tungsten cutters of ultrafine powders resistance of these plates was greater than in comparison with standard 1.05-1.40 times, and iron-CY20 1,22-1,80 respectively. Experimental rollers roll guides ¯ 23 tested under production conditions of "Uzmetkombinat" and rolled over 15531 tons of rolled products without the acceptance of defects. The practical implementation of research results according to the JSC "UzKTZhM" and JSC "Uzmetkombinat" for 2010 amounted to 170.3 million Sums per year. The expected economic effect of implementing the research results will be more than 376 million sums per year.

The results of the thesis are introduced in the educational process on discipline "Materials and construction materials technology" in the amount of 6 hours, "metallic materials" in the amount of 4 hours, with 10 hours for a bachelor's degree in - 5,520,500, as well as the discipline "composite" materials in the amount of 20 hours and "Powder metallurgy" in the amount of 10 hours, a total of 30 hours for the masters in the direction - 5A520510 (acts of 04.05.2010 and 02.04.2014 of the year).

Approbation of research results. Results of research are stated in the form of lecture and have passed approbation on 10 international and republican, scientifically-practical conferences, including: «ʀ ʅ ʅ ʆ ɺ ɸ ʎ ʀ ɕ -2009, 2010, 2011, 2012, 2013, 2014» (Tashkent), «Problems of formation and introduction of innovative technologies in the conditions of globalisation» (Tashkent, 2010), «Problems of formation and introduction of innovative technologies in conditions globalization» (Tashkent, 2010), «Modern technics and technologies of mountain-metallurgical branch and a way of their development» (Navoi, 2010), «Modern materials technology and nanotechnology» (Komsomolsk on cupid, 2010), «Scientific and technical problems in modern mechanical engineering» (Tashkent, 2010).

Publication of the results. According to the thesis topic published a total of 32 scientific papers. Of these, 3 monographs, 14 scientific papers, including 12 national and 2 international journals recommended by the Higher Attestation Commission of the Republic of Uzbekistan for the publication of basic scientific results of doctoral theses.

Structure and scope of the dissertation. The dissertation consists of an introduction, three chapters, conclusions. The total volume of the dissertation is 196 pages.

MAIN CONTENT OF DISSERTATION

In the introduction it is proved the urgency and demand of the dissertation theme, there are formed the purpose and tasks, and also object and subjectof the research, it is held conformity of the research to priority directions of development of science and technology of the Republic of Uzbekistan, it is stated scientific novelty and practical results of the research, it is proved reliability of the received results, it is revealed the theoretical and practical importance of the received results, it is given the list of inculcation in practice of researchȏs results, it is shown data on the published works and the structure of dissertation.

Chapter I **«Condition of a problem and choice of the direction of researches»** is devoted to the current state of the basics of structural materials for engineering with the use of refractory metal powders.

It was noted that the study of the problem involved many authors. The beginning of XXI century was marked by the development of technology of refractory finely divided materials. They are already used in all developed countries of the world in the most important areas of human activity (industry, defense, information sphere, electronics, energy, transportation, biotechnology, medicine, etc.). Analysis of the growth of investment, the number of publications on this topic require the introduction of fundamental and applied research and technology make it possible to develop ultrafine refractory materials in the coming years, which is one of the most important and at the same time, the most promising new research directions.

Formation and development of scientific school in the field of physical chemistry and technology of plasma processes in metallurgy and materials processing took place under the influence of the fundamental ideas of prominent metallurgist academician Nikolai Nikolaevich Rykalin.

Tsvetkov J.V, bringing together his students and colleagues, both in what is now the Russian Federation, as well as in a number of Union republics, carrying out the practical implementation of the processes of synthesis and plasma recovery in the Baltic States, Central Asia and Kazakhstan. As an example, studies carried out in Uzbekistan cycle physicochemical and technological properties of fine powders of tungsten and molybdenum. Especially we got the practical implementation on the Uzbek Refractory and heat resistant metal by first time in the world of technology and hardware design of plasma hydrogen reduction of tungsten oxides.

Thus in addition to the sharp increase productivity and improve performance properties obtained from the plasma produced at installing superfine powders, there was a decrease of energy consumption as the actual recovery process, and the subsequent process stages. Thus, the position was formulated; to a large extent determine the prospects for the plasma industry as a whole at the optimal structural and technological design of plasma processes are energy and resource efficient, while ensuring compatibility with the environment.

Analysis of the literature showed that at the present time using plasma-chemical method is a schematic possibility of obtaining fine powders of most refractory metals. The results of studies conducted in many countries, according to the real possibility of the use of fine powders of refractory metals for the manufacture of structural, instrumentation, and other materials with enhanced performance characteristics.

Currently, obtaining fine powders of refractory metals is regarded worldwide as one of the areas that define the scientific and technological progress in the XXI century. The fineness of one of the most important parameters that determine the properties of matter. Development of the surface creates an additional energy component, which may be useful in processes involving solids, including their conditions of compaction. Thus we formulated the purpose and objectives of this thesis.

Chapter II **«The object and technique of research»** are given objects of research. The object of the research is to install a hydrogen plasma recovery RSV-300 ultrafine tungsten powder and used in engineering materials: hard alloys BK6, BK8, BK15 (GOST 3882-74), high-speed steel P6M5 GOST 19265-73, molybdenum alloy Mo-TiC, made by powder metallurgy, steel 40ʍl Mʃ steel 40ʍl ʄ ʌ ʃ (GOST 977-75) and others.

The phase composition of the transition layer in the cast bimetallic compositions was determined by sequential removal of layers with a pitch of 0.1-0.2 mm in the X-ray machine DRON-2 at Fekɑ radiation. Shooting Mode U = 35 kW; 1 = 20 mA; removing the diaphragm in the order from the x-ray tube 1: 10: 0.25 mm; Soller divergence slit was 2.5 deg .; speed chart tape - 720 mm / hour; speed counter movement - 2° C / min.

The distribution of elements across the cross section of the transition zone defined by a scanning electron microscope S-80 with energy dispersive X-ray microanalyzer on a solid-state detector, Si (Li) "Link" system. The composite steel ʈ 5M5 - steel 40ʍl Mʌ ʃ studied the distribution of the elements W, Mo, Cr, V, Cu, Ni, Fe. The composite solid BK8 alloy - steel 40ʍl ʄ ʃ sintered molybdenum alloy system Mo-TiC - Steel 40ʍl ʄ ʃ investigated, respectively, the distribution of the elements W, Co, Cu, Ni, Fe and Mo, Cu, Ni, Ti, Fe.

The microstructure of the transition zone of the compound was studied by means of metallographic microscope MIM-8 and a scanning electron microscope SEM-200. Microsections Preparation was carried out in accordance with known methods.

Change of properties of the cross-section of the transition zone estimated distribution of microhardness (Micro Durometer PMT-3, P = load of 100 g, Step h = 0, l mm).

To determine the composition of the impurities used methods of neutron activation analysis, mass spectrometry, spectral analysis.

Strength test compound - "shear strength" was conducted on the test press for PMR-5 in model samples and for directly casting by displacing the inserts relative to the tool housing.

Research the state of stress in the housing insert conducted on model samples, and directly on the casting, the voltage determined by the strain. Load cells PDV-10/100 glued in two mutually perpendicular radial directions on the box. Sensor readings with an instrument VDTS-1 were taken before and after the removal of the base substrate of the composite. The difference in the testimony served as a basis for calculating the level of residual stress and internal plate.

Measurements technological and operational characteristics of powders and preforms made using existing standard methods and measuring devices park.

Chapter III **"Improvement of technology of receiving new composite materials with tungsten use. Research structures and structure of UDP of tungsten"** of the dissertation is devoted to theoretical and technological bases of creation of construction materials based on ultrafine tungsten powders.

It is shown that in important technological aspects of creating structural materials include production of metals by plasma reduction of tungsten oxides.

Contact material plasma radiation depends mainly on the energy density, duration, wavelength, and the physical properties of the substance. Part of the radiation is reflected and the rest is absorbed by the radiation. If the density of the radiation is small (£ 1010 W / m2), the energy of the absorbed radiation portion is converted into heat, which is distributed throughout the material by thermal diffusion.

At higher radiation density is an intensive local heating of the surface (the temperature rises to 1010 K / s), and the ability to repel the drops by half its value. Thus, a molten bath reactor around the depth (Qt) 1/2, where Q-thermal conductivity, t-plasma pulse duration. Further increase in flux density causes an increase in temperature to a value corresponding to the point on the surface of the molten bath boiling and evaporation process starts. This will happen when the absorbed energy will be approximately equal to the latent heat of vaporization LS is given by:

$$L_S \approx \frac{1}{P \cdot \tau \cdot \rho \cdot \sqrt{Q \cdot \tau}} , \qquad (1)$$

where P - the radiated power, r - density substances, Q - heat conductivity, t - duration of the plasma pulse.

It is assumed that at sufficiently high densities of energy flows reached temperatures of many hundreds of eV, the critical density of the particles in the plasma can approach $n_c \cdot \lambda^2 \approx 10^{15} \frac{1}{ʤ}$, (2)

where n_c ï radiation density, λ ï the length of the plasma beam wave. Hence, when λ = 1 ʤ£ʤ the achievement of a critical density of radiation $n_c \cong 10^{27}$ ʤ^{ï1} beam penetrates the surface of the material and further heating to be produced indirectly, reemitting plasma (Figure 1). Plasma enters the mode of self-regulation, where its cooling expansion balanced by absorption of radiation, which causes movement of the critical density threshold toward the plasma. In this mode, an increase in particle velocities up to 104 m / s at normal atmospheric pressure.

The speed of the hot gases at the outlet section of the plasma torch (Figure 1):

$$U_o = \frac{G_{H2}}{S_B}, \text{ м/с} \qquad (3)$$

where G_{H2} – hot gases flow in the outlet section of the reactor ($м^3$/s);

S_B – area of the outlet section of the hot gas jet boundary layer ($м^2$).

During movement of liquid and gas in a medium with the same physical properties occurs during jetting, which is characterized by the presence of the tangential discontinuity surfaces. Jet flow covered abroad tangential discontinuity has a finite thickness and is called the jet boundary layer. Upon expiration of the jet holes (nozzle) forms a portion of the length of three (Figure 1): I - an initial portion which is characterized by a core of laminar flow of the plasma stream; II - a transition area where the laminar flow becomes turbulent; III - the main site, where the developed turbulent flow.

Selected theoretical model to determine the parameters of the jet in a first approximation.

The thickness of the boundary layer of the jet stream marked models are determined by the law of conservation of momentum:

$$\rho U_0^2 b_0 = \rho U_{x}^2 b_{x} \int_0^1 \frac{U_{x}^2}{U_{x}^2} d\left(\frac{Y}{b_0}\right), \qquad (4)$$

where ρ - density of the flowing medium; U_0 - velocity of the axis at the nozzle exit; b_0 - half-thickness of the boundary layer of the jet at the end of the initial section; U_x - the current speed of the jet thickness of the boundary layer; b_x – The current half-thickness of the boundary layer jet; Y – the current value of the jet boundary layer thickness.

Approximating the formula (4) for evaluation, the velocity distribution across the thickness of the initial portions of the jet the boundary layer can be found by the expression:

$$\int_0^1 \frac{U_x^{\ 2}}{U_0^{\ 2}} \cdot d\left(\frac{Y}{b_1}\right) = \int_0^1 \left(1 - 6\cdot\omega^2 + 8\cdot\omega^3 - 3\cdot\omega^4\right)\cdot d\omega \qquad (5)$$

where ω – related to the boundary layer thickness of the boundary layer of the floor.

The estimated dependence of falling average speed along the jet flow in the initial section can be estimated by constructing a graph of (Figure 2.) The average rate of change of direction from the nozzle by the expression:

$$\int_0^1 \frac{U_H{}^2}{U_0{}^2} \cdot d \cdot \left(\frac{y}{b}\right) = \int_0^1 \left(1 - 6 \cdot \varpi^2 + 8 \cdot \varpi^3 - 3 \cdot \varpi^4\right) \qquad (6)$$

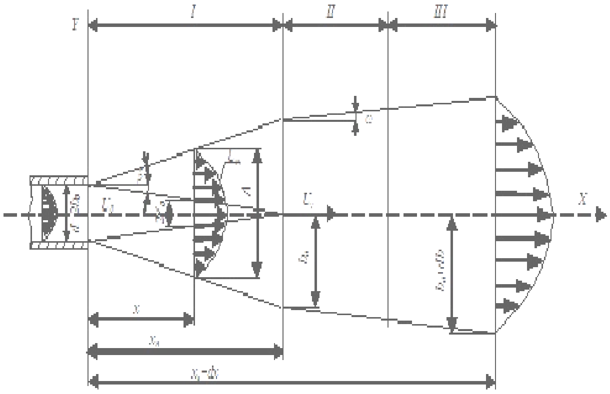


Fig.1. The geometric shape of the jet in the reactor 1, the potential core; 2-turbulent boundary layer.

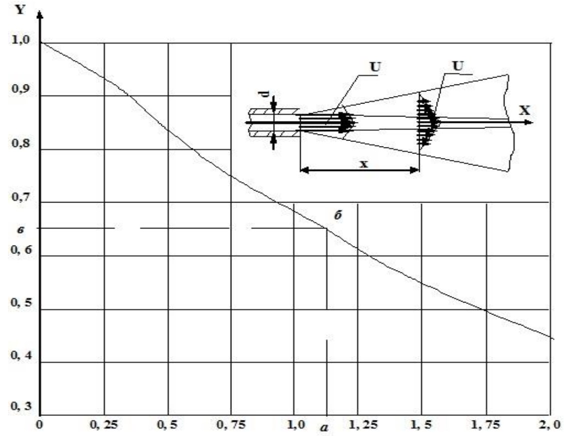


Fig.2. Falling average jet velocity along the direction nozzle exit.

Assuming the average speed at the nozzle exit, you can find a drop in the average jet velocity along the direction of the nozzle section (Figure 2). To do this, select the required distance x from the outlet of the nozzle and is determined by the value of the caliber x/d_0 (Point A in Figure 2). From point and held vertical to the intersection with the curve $U_x/U_0=f(x/d_o)$ (Point b). From the point b is held horizontal line to the intersection with the y-axis (point in), which determines the value $U_м/U_0$.

The value at the point b is the average speed ratio to fall randomly selected distance x. The absolute value of the speed in the section of the jet from the nozzle section at a distance x is: $U = \frac{U_x}{U_o} U_o$.

Thus, it is possible to determine the average velocity of the jet at any distance from the nozzle within the initial portion of the jet, wondering average speed on exiting the nozzle, it is possible to find the average drop velocity along the jet direction of the nozzle outlet (2), for the model of the jet stream.

At higher radiation density is an intensive local heating and evaporation process begins with the surface of the molten bath.

Note that for the metal evaporation process begins when the flux density is higher ***t*** $>10^{10}$ï 10^{11}, W/m^2 ɖ evaporation occurs in about 4 ms. This will happen when the absorbed energy will be approximately equal to the latent heat of vaporization L_S:

$$L_S \approx \frac{P \cdot \tau}{\rho \cdot \sqrt{Q \cdot \tau}} \; , \qquad (7)$$

Where t ï radiation power, ρ ï the density of matter, Q ï thermal conductivity, τ ï the duration of the plasma pulse.

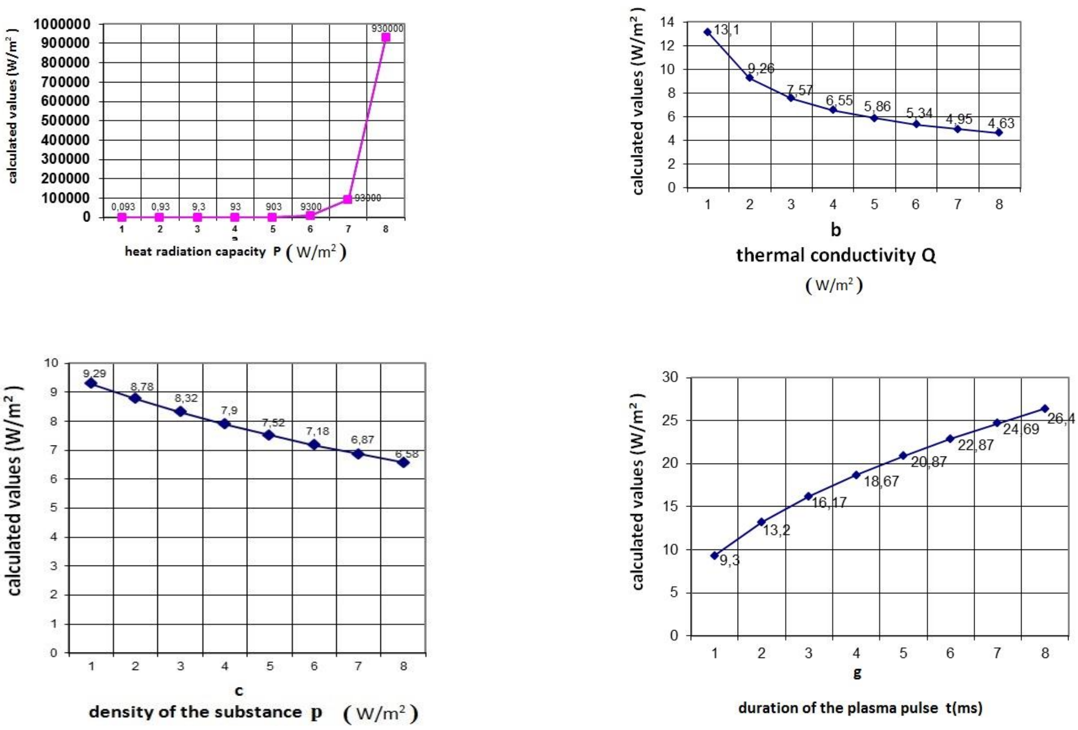


Figure 3. The dependence of the calculated values of the latent heat radiation capacity (a), thermal conductivity (b), the density of the substance (c), the duration of the plasma pulse (g).

Calculations have shown that an increase in output power (Figure 3a) has a significant impact on the growth of the latent heat of vaporization in the reactor plasma torch, which is the most important factor in energetic structure formation; changing the thermal conductivity of growth (Fig. 3b) of the substance leads to a slow reduction of the latent heat of vaporization of the plasma torch in the reactor and increase the density of the substance (Figure 3, c) leads to a slower decrease of the latent heat of evaporation, it is possible as a result of deliberate regulation process structuring. Increasing the duration of the plasma pulse (Figure 3, c) has little effect on the increase of the latent heat of vaporization in the plasma torch reactor.

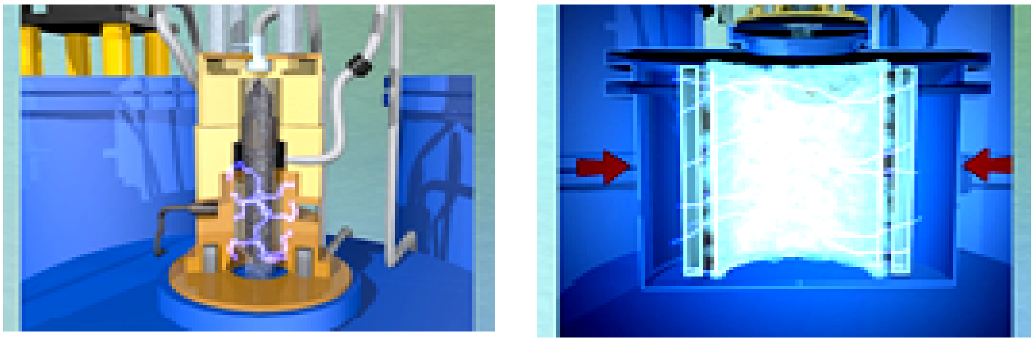
Thus, theoretically justified the possibility of improving the technical process of upgrading an existing installation of ɿ ʋ Ι - 300 of structure and optimization technology.

Chapter IV **«Technology of heat treatment of tools with use of UDP of tungsten»** describes a new design of plasma chemical reactor and heat treatment technologies manufactured instruments with the use of ultrafine tungsten powders.

Plasma chemical recovery process in a conventional reactor wherein d / D is equal to 1.10, lasts no more than 0.03 seconds, and with the free flow of plasma in a large amount after rapidly loses heat energy reserves, however, some of the powder, the peripheral region has got jet remains non-reinstatement.

Therefore, based on the analysis of dissertation thermophysical calculation results suggest a new process to upgrade an existing installation of ɿ ʋ Ɉ -300 (Figure 4).

Energy is introduced into the reaction zone, not only in the form of a plasma jet, but in the form of an additional flow of gas heated to a high temperature flowing into the reaction zone through a porous, permeable wall heated by electrical heater.



a) b)

Figure 4. The processes occurring in the installation "ɿ ʋ Ɉ -300": a process of plasma in the plasma generator; b - the process occurring in the reactor.

Figure 5 is a longitudinal sectional view of the plasma chemical reactor; coaxial cylinders, a top view, section AA; coaxial cylinders, cut B-B and includes a housing 1, plasma generator 2, the injector nozzle 3 arranged in the upper part of the housing, in the inner cylinder, for feeding into the plasma stream of the reactant mixture - tungsten anhydride with gaseous reactant nozzle 4 to enter the gas reagent in the near-wall hollow body 1.

The body 1, on its central axis, has two coaxial hollow cylinders 5 and 7. The cylinder 5 installed in the center, the entire surface thereof, formed in a staggered manner tangential openings 6 that act as nozzles for supplying the gaseous reactant.

On existing plasma device technology research with the use of a new reactor were held.Our proposed new plasma chemical reactor for dispersible powders of refractory metals from the existing analogues characterized in that the central axis of the plasma chemical reactor casing coaxially mounted two hollow cylinders, between which the electric heater, and the cylinder, installed in the center, an annular nozzle formed by the tangential holes placed in a staggered manner over the entire cylinder surface. These design technological changes have improved the efficiency of the plant with a new reactor.

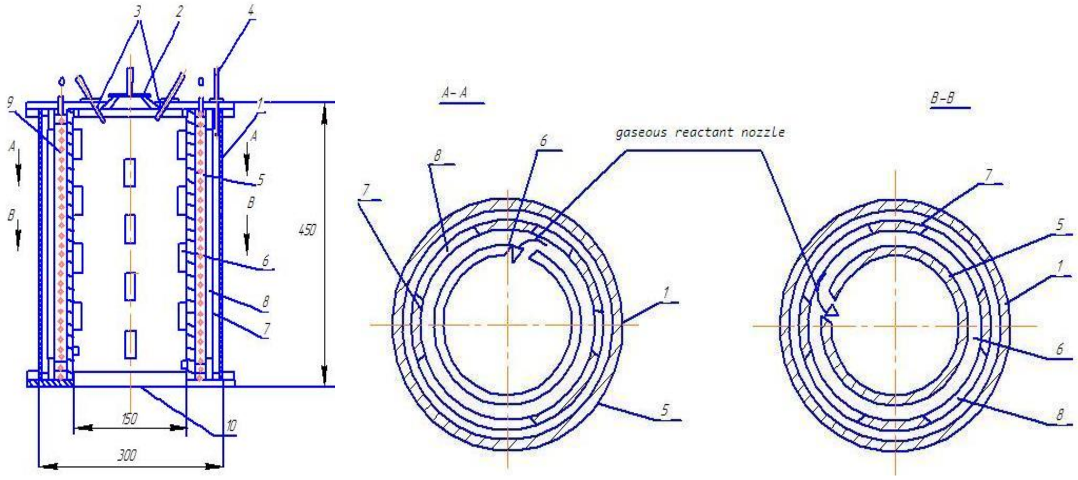


Fig. 5. The design concept of the new plasma chemical reactor: 1 body, 2 plasma generator, a coaxial 3-cylinder, 4-nozzle 5,7-cylinder, 6-hole, 8-slot, 9-electric heater, 10 outlets.

The study used a plasma tungsten powders selected from the installation RSV-filter 300, the characteristics of which are presented in Table 1.

Power torch lingered within 45-55 Watt heater capacity - 16-18 kW, the hydrogen flow through the plasma generator 20 dჳ / h, through the heater from 40 to 60 dჳ / h. Flow rate of the tungsten oxide - 10.6 kg / hr. The temperature of the heated hydrogen 1500-16000 C. Thus, the total capacity was not more than 75 kW, and the total hydrogen consumption - up to 80 dჳ / h, at the same time the power of the plasma torch according to the traditional scheme is 100 kW at a hydrogen flow rate of 75 vz/h.

Study dispersion obtained powders revealed that the average grain size according to Fisher is 70 - 90 nm at the oxygen and moisture vapor content of 0.5% (Table 1).

Granulation of powders produced in the mixer rotating on its axis in the horizontal and vertical planes. Testing of annealing conditions, sintering was carried out at the production plant equipment ¯ 2 (ɺ ʋ ɺ -300 flail-214, STN-1,6) JSC "UzKTZhM".

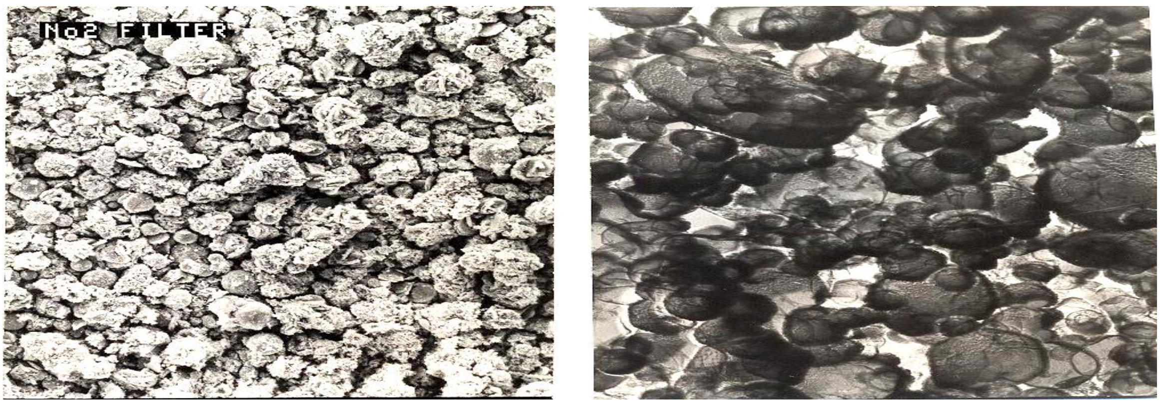
During the preparation of the new tungsten powders reactor settling chamber below the reactor powder is almost not detected, it indicates that the incoming tungsten oxide appeared fully recovered and ultrafine powders of tungsten on the filters were. Electron micrographs of ultrafine tungsten powder obtained by reduction of tungsten oxide have shown that more than a sphere-like shape (Figure 6 (a)) of ultrafine particles is not typical for large tungsten particles. Detected cases, if not to

Table 1

The grain size according to Fisher, and the mass fraction of oxygen in the powders obtained in plasma-chemical reactor

– ʧ ʧ	Sampling point	The grain size according to Fisher, nm	Bulk density, g / cm^3	Specific surface area, ʤ^2/g	Oxygen content in %
1	Standard powder	600	4,4	0,1	0,8
2	UDP W with filter	90	0,70	4,0	0,5
3	UDP W with the spin chamber	90	0,82	5,8	0,5
4	UDP W with filter	70	0,90	8,0	0,4

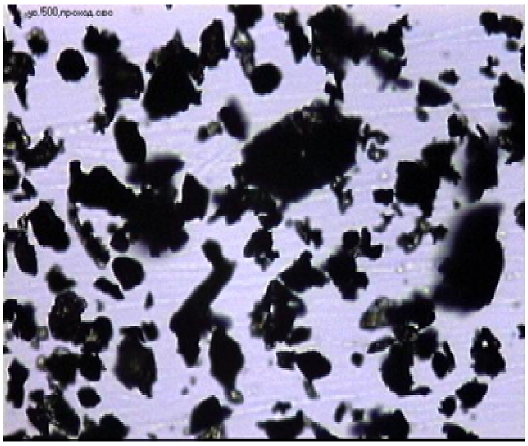
take special measures, the UDP under the influence of various kinds of power: power, dispersion, magnetic, can form conglomerates (Figure 6 (b)). The strength of the conglomerates is increased in some cases, so that separate them into the precursor particles even with modern disperegatorov practically impossible. This leads to undesirable effects, make it impossible to re use the expensive material.



ʘ) b)

Fig. 6. Electron microscopic image of the spherical form of powders (a) and the formation of conglomerates (b) ultrafine tungsten powders (h100000).

Ultrafine morphology (Figure 7) shows the particle that powders of ultrafine grain W, obtained by reduction of the hydrogen-plasma consists of two component systems Ǔ-W and β-W. This powder proved to be more fine-grained, with a pronounced allotriomorphism debris (formlessness) and from the analysis of the diffraction patterns (Figure 8), it can be concluded that the values of the interplanar distances of atoms indicate the affiliation of the powder to pure tungsten metal.



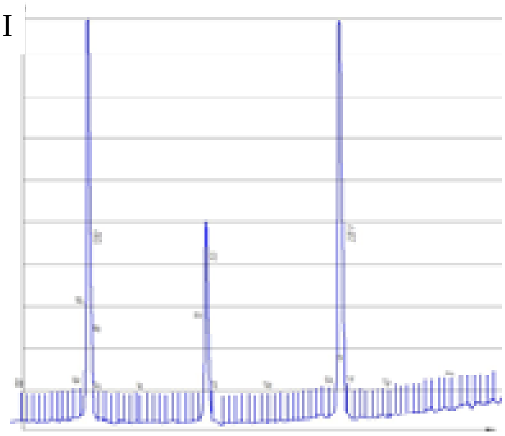
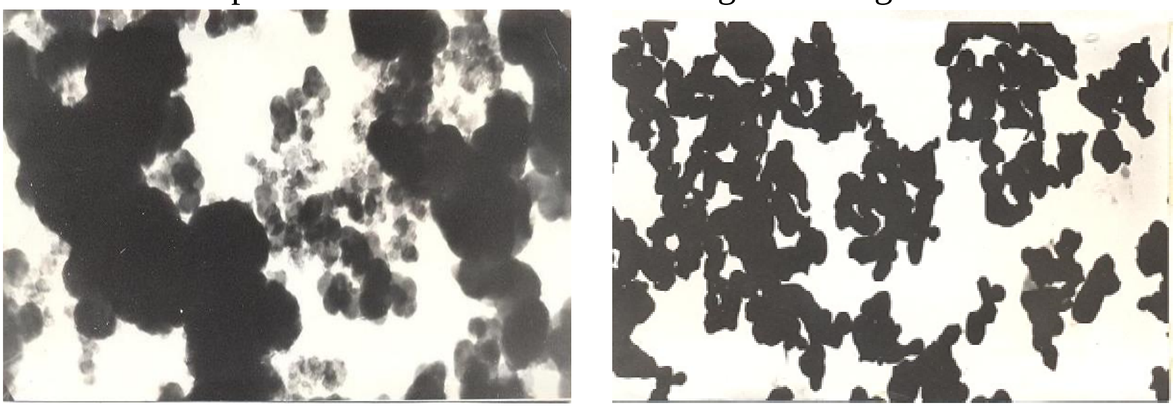


Fig 7. The morphology, structure of ultrafine tungsten carbide powders (h50000).

Fig.8. The XRD pattern of tungsten metal powder.

Electron microscopic studies of tungsten carbide powders on the basis of the standard and "non-reinstatement." (Figure 9) shows the formation of ultrafine powders are more evenly distributed fine-grained structure, virtually without formation of conglomerates like standard. Local fluctuations satiety, resulting in turbulent plasma medium, high temperature gradients (10^3 ° C / m), high speeds and quick reactions during the process (10^{-2}-10^{-3} c) create nonequilibrium conditions of crystal growth. For this reason, different from the shape of the crystals obtained in plasma chemical reactors existing technologies.



ʘ) b)

Figure 9. Electron micrographs of tungsten carbide powders on the basis of the standard (s) and "pre recovered" ultrafine (b) h50000.

To reduce the oxygen content in the tungsten powder product proposed trap graphite or gauze filters installed in the reactor. This method allowed passivation of pyrophoric powder secure but at elevated temperatures (800-16000S) can occur deoxidation its water vapor. Initially, the process was tested with periodic discontinuation feed for 5-10 minutes, during which the product in the filter thermal lowering stream of dry hydrogen. It was determined that after discharging the oxygen content of the powder within it reaches the level of 10-20 days 2-2,65%, then not changing.

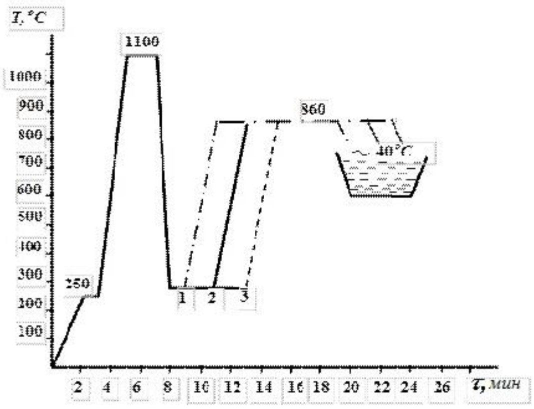
The second method by introducing passivation with hydrocarbon feedstock has been realized by bubbling carrier gas through a gas, which is provided W.A powder alloy which is different from standard fine alloy structure. Thus, the amount of WC grains - phase to 100 nm is 80-85%, and alloys ȷ K10M-65-75%. The average grain size of WC-phase is 110 nm and the alloy ȷ K10M-130-150 nm.

The alloy has a fine grain structure and increased tensile strength compared to bending transversely to the ones produced alloys. This level of properties achieved by milling WC-phase change properties of the cobalt and carbide phases. The combination of high physical and mechanical properties of fine-grained structure and makes high performance. Laboratory tests when processing difficult materials showed an increase in resistance to 1.5-3.0 times in comparison with the alloy ȷ K10M.

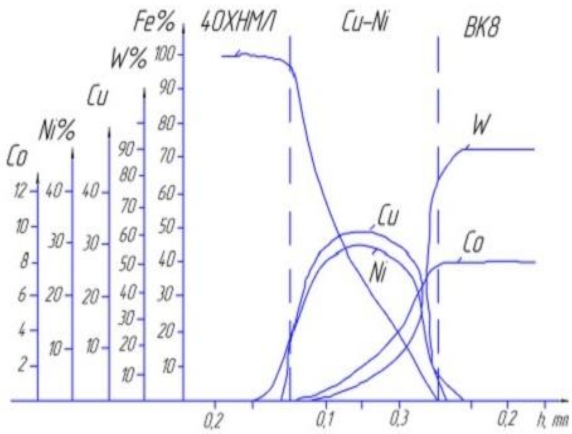
Analysing the results of (Table 1, Figure 5-9) technological research with a new plasma chemical reactor, we can conclude: increased degree of elaboration of raw material and process control, as well as the dispersion of the powder; increased uniformity of grain size; increases the coefficient obtained by the action recovery process.

It is noted that the heat treatment of bimetallic composite is still not paid much attention and as a result it was not possible to fully disclose potential of composites and their structural components. Therefore, the change of dissertation studied the properties of the composite on the state of stress in the body during heat treatment (Figure 10 a) on the treatment: tempering at 220 ° C for 1 hour: Option 1- isotherm holding for 1 minute. at 280 ° C; Option 2-isothermal holding for 3 minutes. at 280 ° C; 3 variant isothermal holding for 5 minutes. at 280 ° C.

To study the base substrate of the original structure before the effect of the secondary phase recrystallization on the stress state of the working tool element and operating characteristics intermediate isothermal holding was carried out in the area of martensite and bainite transformation began 40ʍʅ ʄ ʃ for 1, 3, 5 minutes.



a)



b)

Figure 10. Driving heat treatment (a) and distribution of the elements (b) in the transition zone cast bimetallic composite system BK8 carbide-steel 40ɷɩ ʃ ʃ .

Results of the study (Figure 10 b) have shown that the formation of a composite nickel penetration occurs in the adjacent layers of the steel and the cemented carbide to a depth of 0.1 mm. Zone-based Cu and W enriched Ni and Co from the cemented carbide and iron from the steel. The maximum in the curve of distribution of Cu and Ni is biased towards carbide, which indicates more intensive dissolution of Fe in the melt of the intermediate layer. Relatively high levels of the type of reaction products ʃ $_6$ɥ, ʃ $_3$ɥ It indicates a significant increase in the amount of C phase (up to 52 %).

Table 2

Phase distribution and the cross-section of the composite carbide content BK8 - steel 40ɷɩ ʃ ʃ

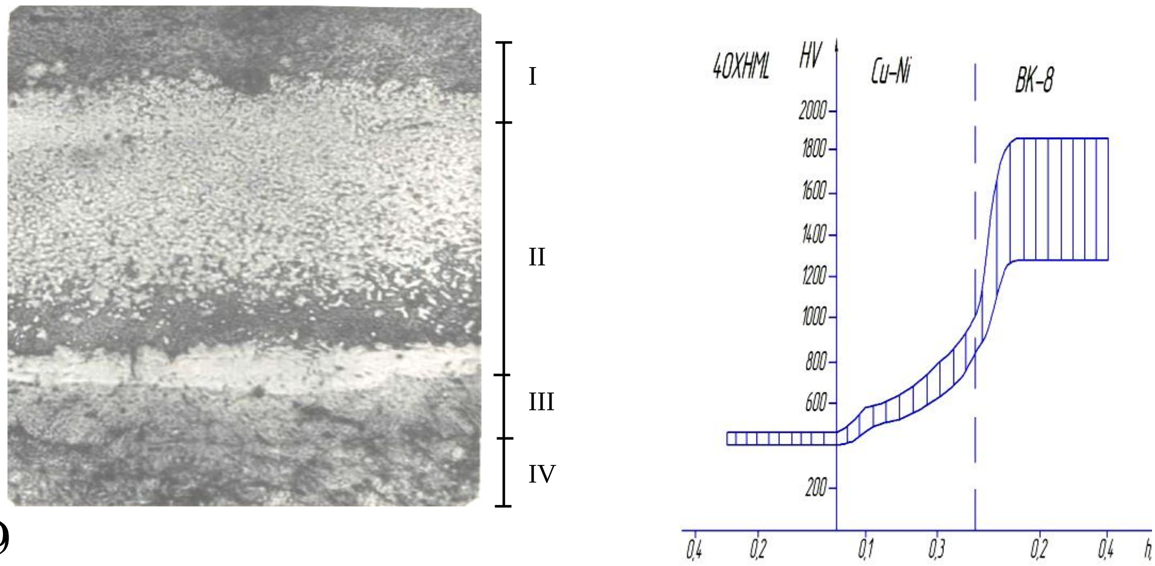
Compositeȏs content	The distance from the interface between the components, ɞɞ*	Relative intensity X-ray lines					
		Phase content, %					
		αï Fe	γï Fe	M_6ɥ	Co	M_3ɥ	WC
Ɉ ȿ 8	0,2	ï	ï	ï	8,0	ï	92
	0,1	ï	ï	ï	7,8		91
The transition zone on the basis of ɥuï Ni	0,1	ï	40	3,6	4,5	ï	51,9
	0,2	47,1	37	3,1	3	ï	9,8
	0,3	79,5	18	1,6	ï	0,9	ï
Steel 40ɷɩ ʃ ʃ	0,1	95,2	3,5	ï	ï	1,3	ï
	0,2	98,7	ï	ï	ï	1,3	ï

** The distance (in the cross-section of the transition zone) was determined according to metallographic analysis.*

Phase stratified analysis of the transition zone (Table 2) confirmed the active engagement of Cu-Ni alloy melt to a solid. Penetration of nickel steel is accompanied by the formation of retained austenite. The transition zone is contained in a large amount γï Fe (ʜts 30%). The transition zone composite comprises the following phases: αï Fe, γï Fe, ʃ $_{6}$ʉ, ʃ $_{3}$ʉ, ʃ ʉ, and by carbide forming ʉ ts.

The microstructure of the transition zone includes the following specific areas (Figure 11, a): 1st - zone from solid alloy, has high etched and increased the distance between the carbide particles; Second band-shaped based intermediate material layer comprises etching the cortical layer and austenitic phase inclusion carbide structures of arbitrary shape. The size of 0,15-2,0 mm zone; 3rd-crust area with fine-grained structure to 0.05 mm thick; 4th zone - carburizing carrier base material of the composite polystyrene gasification products c perlite-cementite structure is gradually transforming into a ferrite-pearlite structure doevtektoidnoy steel.

Measurement of microhardness over the cross section of the composite transition zone showed that in the adjacent area to the solid alloy hardness is a decrease compared with the original hard alloy (from 1600-1800 HV to 600-1000 HV). And on the basis of the intermediate layer material, a sharp drop of hardness up to 400 HV. The hardness of the crust and the adjacent carburizing zone gradually decreases from 300-400 HV up to 200-240 HV (Figure 11, b).



ʘ)

b)

Fig. 11. The microstructure of the transition zone (a) and distribution of microhardness (b) the cross section of the composite system ɺ K8 - steel 40ʍʅ Mʃ)
1-migration zone; II area-based middleware; Zone III - the crust;
Zone IV - carburizing, x 150.

According to the proposed mode implemented heating carbide tools to a temperature of 250° C for Z minutes, heating up to 1100° C temperature for 5 min, isothermal hold at a temperature of 280° C for 3 min, the secondary heating to 860oS temperature for 15 minutes, quenched in heated oil. Tempering at a temperature of 220° C-1 hr.

Thus, the proposed new method and heat treatment regimes carbide tools, significantly increases the service life and reliability.

Chapter V **«Applied aspects of application of results of research and assessment of their technical and economic indicators»** shows the practical aspects of applying the results of research and assessment of their technical and economic parameters.

A production technology of metal, metal-cutting, shaping, drilling and other tools for different purposes using ultrafine tungsten powders.

The working part of the matrix material for pressing carbide inserts carbide taken BK8 GOST 3882-74.V template for synthesis of the STM 150 mm in diameter was used carbide BK6 GOST 3882-74 and sintered molybdenum alloy Mo-TiC.

Inserts of cemented carbide made from tungsten UDP. Finished elements degreased in vitro caustic solution and acetone, and in the production - in an ultrasonic bath for

Khladone 8-10 min, then incubated for 8-10 minutes in water with the addition of emulsifier, followed by washing. After degreasing, drying was carried insertion. The use of copper and nickel wire diameter (0.1-0.6 mm) as an intermediate layer. The wire in the form of a band worn on the work item before you put it in a mold.

Optimization of technological parameters of the intermediate layer was conducted with the assistance of the method of mathematical planning of experiments. Implementation of the plan of full factorial experiment N = 23 to determine the dependence of the strength of the connection between the elements of the composite, has found expression in the form of regression equations for composite sintered molybdenum alloy system Mo-TiC-steel 40ʍʅ ʄ ʃ :

$$y = 194 + 23{,}5X_1 - 16X_2 + 36{,}5X_3 + 2X_4 + 6X_5 - 3X_6 + 5{,}2X_7 \quad (8)$$

where X_1 ï wire thickness, X_2 ï pitch between coils, X_3 ï Nickel content of the shroud, X_4 ï joint cooperation X_1X_2, X_5 ï joint cooperation X_1X_3, X_6 ï joint cooperation X_2X_3, X_7 ï joint cooperation $X_1X_2X_3$.

After the statistical evaluation of the significance of the coefficients found that the following factors were significant regression equation:

$$y = 194 + 23{,}5X_1 - 16X_2 + 36{,}5X_3 + 6X_4 \tag{9}$$

Using the method of steep ascent in the determination of the maximum value of the parameter optimization, we installed the corresponding values of factors influencing the process of forming a transition zone for each variant of composites, which was adopted as a basis for further research.

Working element composite - insertion of a solid and a molybdenum Mo-TiC system alloy, an intermediate layer in the form of a band made from copper and nickel wire with a ratio of 3: 2, the base substrate - Structural steel casting and 40ʍʅ Mʃ 40ʍʅ Mʌ ʃ . Bimetallic alloy composites provide high performance tools.

Made experimental batches of samples of cutting and shaping tools made of ultrafine tungsten powders. These samples were tested in a production environment NMP SE "NMSC" GAO "TAPOiCH" and JSC "UzKTZhM".

Experienced industrial lots of die, metal cutting and shaping tools with the use of ultrafine tungsten powder production tested and found that the processing of the incisors ultrafine tungsten powder resistance of these plates was more than compared to the standard in the 1.05-1.40 times, and iron Cʏ 20, respectively 1,22-1,80. Experimental rollers roll guides ¯ 23 production tested in the conditions of "Uzmetkombinat" and rolled over 15531 tons of rolled products without the acceptance of defects.

The practical implementation of research results according to the JSC "UzKTZhM" and JSC "Uzmetkombinat" amounted to 170.3 million. Sums in 2010 year. The expected economic effect of implementing the results of the study will be more than 376 million. Sum per year, at a price of costs for raw materials and 2010 Technology of the Year.

The results of the thesis are introduced in the educational process on discipline "Materials and construction materials technology" in the amount of 6 hours' non-metallic materials "in the amount of 4 hours only 10 hours for undergraduate specialty - 5520500, as well as the discipline of" composite "materials in the amount of 20 hours and "Powder metallurgy" in the amount of 10 hours, a total of 30 hours for a master's degree - 5A520510.

Conclusion

It is shown that by far the leading role played by plasma technology, which allows intensifying the process of obtaining pure metals, ensuring the preservation of their special physico-chemical and technological properties and the creation of materials with enhanced performance characteristics.

Grounded geometric and technological parameters of the new reactor for ɟ ʋ Ɉ -300 are based on the modernization of the existing technologies.

On the basis of theoretical and experimental research and analysis of the results for the first time offer a comprehensive scientific, technical and technological methods and recommendations to identify further ways of development of high-tech processes in mechanical engineering, contributing to the development and expansion of scientific research, as well as being important for the sectors of the economy as a whole.

The following may be mentioned as the main findings of the research:

1.Study aerodynamic particle movement process of boiling a liquid-gas phase environment is scientifically proved and selected mathematical model to estimate the average speed of the fall in the output section of the jet nozzle reactor RSV-300, which made it possible to establish a pattern and change the latent heat from the basic thermodynamic factors: radiation power, thermal conductivity, density, and the duration of the plasma pulse.

2. Performed thermophysical calculation for verifying the plasma chemical reactor designs and operating modes ɟ ʋ Ɉ -300: found that the arc current is between 0.45 and 0.55 SC, arc voltage 380 to 410 V, the hydrogen flow rate through the plasmatron from 60 to 70 $ʤ^3$ hydrogen consumption for transportation of tungsten anhydride from 2 to 4 $ʤ^3$ / h, water consumption in the plasma torch from 2.15 to 3.6 $ʤ^3$ / h.

3. For the first time proposed a new plasma-chemical reactor for the production of ultrafine powders of refractory metals, to significantly improve the performance of the process equipment. It increases the degree of elaboration of the raw material and process control, as well as the dispersion of powder risen uniformity of particle size distribution, increased coefficient obtained action recovery process that is possible to obtain with the required quality characteristics of ultrafine tungsten powders. The physical model of the reactor of the plasma torch for approximate calculation to determine the latent heat of vaporization.

4. It is demonstrated that the increase in output power has a significant impact on the increase of the latent heat of vaporization in the plasma torch reactor, which is the most important factor in energetic structure formation. Changing thermal conductivity material growth leads to a slow reduction of the latent heat of vaporization of the plasma torch in the reactor and increase the density o

substance leads to a slower decrease of the latent heat of evaporation, as a result it is possible to regulate targeted structuring process.

5. Offered heat treatment regimes for passivation powders. It was determined that after discharging the oxygen content of the powder in it for 20 days reaches 2,0-2,65%, then not changing. To reduce the oxygen in the tungsten powder product proposed trap or graphite metallic-textile filters installed in the reactor. A method of passivation by entering with hydrocarbon feedstock and carrier gas bubbling through the fuel, which gave the best results and is used in research.

6. Offered a new method of manufacturing a bimetallic cutting and punching tools using ultrafine tungsten powders. The basis of the invention is to improve the performance of the bimetallic cutting and punching tools, as well as the expansion of its range due to the reliability of the connection tool part and supporting part as a result of the interaction of the intermediate layer with controlled composition, its constituent components with adjacent layers of steel included in the composites.

7. A new method of manufacturing a bimetallic cutting and punching tools using ultrafine tungsten powders. This will increase the range of applications of bimetallic cutting tools and stamps.

8. A heat treatment regime of the fast tool increases the reliability of operation due to optimization of structure of bimetallic composite. This will increase the tool life of high-speed steels.

9. A method of heat treatment of the cast bimetallic carbide tool to simplify the heat treatment technology and to increase tool life by 30-40%.

[illegible]
LIST OF PUBLISHED WORKS
[illegible] (I [illegible] ; I part)

1. [illegible], 2010. – 160 [illegible]

2. [illegible], 2012.-136 [illegible]

3. [illegible], 2015. – 168 [illegible]

4. Salokhiddin D. Nurmurodov, [illegible]lisher K. Rasulov, Nodir D. Turahadjaev, Kudratkhon G. Bakhadirov. Development of New Structural Materials with Improved Mechanical Properties and High Quality of Structures through New Methods. Journal of Materials Science Research, Vol. 5 No. 3, July 2016 e-Version First tm, pp. 52-58. (05.00.00 – 5).

5. [illegible], 2010. – [illegible] 4. [illegible] 45 – 47.[[illegible] 13].

6. [illegible], 2009. – 5. – [illegible] 29 – 32. (05.00.00 – 12).

7. [illegible], 2010. – 1-2. – [illegible] 80–84. (05.00.00 – 16)

8. [illegible], 2011. – 1-2. – [illegible] 103–108. (05.00.00 – 16).

9. [illegible], 2012. – 1-2. – [illegible] 92–96. [[illegible] 16].

10. [illegible], 2013. – [illegible] 2. [illegible] 105 – 108. (05.00.00 – 16).

11. [illegible], 2014. – [illegible] 3. [illegible] 103-107. (05.00.00 – 16.)

12. [illegible] .2014. – 3. – [illegible].69–71. (05.00.00 – 13).

13. [illegible] 2015. – 3. – [illegible]. 29–32. (05.00.00 – 13).

14. [illegible] – IAP 04531.. [illegible] 27.06.2012.

15. [illegible] – IAP 04732.. [illegible] 26.06.2013.

16. [illegible] – IAP 04728. 05.06.2013. [illegible] 05.06.2013.

II [illegible] (II [illegible] ; II part)

17. Salokhiddin D. Nurmurodov, [illegible]lisher K. Rasulov, Nodir D. Turahadjaev, Kudratkhon G. Bakhadirov. Procedure-Technique for New Type Plasma Chemical Reactor Thermo-physical Calculations. American Journal of Materials Engineering and Technology Vol. 3, No. 3, 2015, pp. 58-62.

18. [illegible] 2012. – 3. – [illegible]. 66–68.

19. [illegible] 2012. – 4. – [illegible]. 62 – 64.

20. [illegible] 2012. – – 4. [illegible]. 51 – 54.

21. [illegible] "[illegible] – 2009". [illegible] 2009. – [illegible]. 98-99.

22. [illegible] 2010. – [illegible]. 84-88.

23. [illegible]

lsj ̄dzsGj dzdz ̄ tsls ̄tsHtsɘ ʗ dʒfnʝsdzsGts fŋ te' w». ï ʊΘ Ϛj dzs, 15ï16 ΘʄteJdz 2010 G. ï ʉ. 303ï304.

24. ɩ lztedʒztetsHtsɘ ʉ.ɼ. ɟ tetsʗLɘtsHfnʝsɘts ɘtsdz w teΘdʒsɘtsGts ʧtstets h ϚΘ - ʧdzΘLdʒdzdzsGts ɘtsfnʝsΘdzsɘdʒdzʗ w: ʄ ΘsJteʗΘdz ʄ jʮ HlzdzΘtetsHdzsʡ dzΘlzɥdzs-lsj ̄dzʗɥjfnʄtsʡ Ϛtsdz w jteJdzɻʗʗ «ʉtsɘteJdʒdzdz j lsj ̄dzʗϚΘ ʗ lsj ̄dzsdzsGʗʗ Gtstedzs-dʒlsΘdzdzteGʗɥjfnʄtsʡ tslsteΘfnʝdzʗ ʗ ʧlzlsʗ ʗ ̄ teΘLɘʗlsʗ w». ï ɩ Θtsʗ, 12ï14 dʒΘ 2010 GtsHΘ ï ʉ. 254ï255.

25. ɩ lztedʒztetsHtsɘ ʉ. ɼ., ɸ dzʗdʒsɘ ɿ.ɪ. Ɔ ʗʡʗdz ʵ teʗʡHʗGΘdz dʒlsΘdzdzΘG ϚΘteBʗHdzΘteʗ ΘfnʝsfnʝʗHΘGʗ ɣΘslsʗɣ ɣtslsʗ h dʒΘdzΘG ʗ h dzΘB ɥʗɣΘteʗ h lsj ̄dzsdzsGʗ w dzΘteʗ. ʌΘdzɣΘtets ʗdzdʒʗʡ ï Θdzɣlzdʒ Θdz ʀ dzdʒʗʡ dʒΘɣtsdzΘdzΘG ls^ʧdzΘdʒʗ. "ʀ dzdzsɘΘɥʗ w ï 2010". ï ʊts h Ϛj dzs, 2010. ï 120ï123 в.

26. ɩ lztedʒztetsHtsɘ ʉ. ɼ., ɸ dzʗdʒsɘ ɿ.ɪ. ʄ ʗdzʗ-ʧdzΘLdʒΘ y ʡ ɣlzteʗdzdʒΘfnʝʗHΘ w dzʗ Ϛtsdzfnʝstedz Ϛɥʗtsdz dʒΘsJteʗΘdzdzΘG tsdzʗ h lsj ̄dzsdzsGʗ w fnʝʗ. ʌΘdzɣΘtets ʗdzdʒʗʡ ï Θdzɣlzdʒ Θdz ʀ dzdʒʗʡ dʒΘɣtsdzΘdzΘG ls^ʧdzΘdʒʗ. "ʀ dzdzsɘΘɥʗ w ï 2011". ï ʊts h Ϛj dzs, 2010. 190ï192 в.

27. ɩ lztedʒztetsHtsɘ ʉ.ɼ. ʀ fnʝfnʝdʒHtsɘΘdzʗj fnʝstedzʡdzs-ʧdzΘLdʒdzdzsGts ʧtets ɥjfnʝΘ ɘtsfnʝsΘdzsɘdʒdzʗ w lsteJ ̄tsϚʗfnʝ ɘtsdz w teΘdʒΘ dzΘ lzϚtedzʧdʒdzdzsʡ lzfnʝsΘdzsɘϚj: ʄ ΘsJteʗΘdz ʄ jʮ HlzdzΘtetsHdzsʡ dzΘlzɥdzs-lsj ̄dzʗɥjfnʄtsʡ Ϛtsdz w jteJdzɻʗʗ "ʉtsɘteJdʒdzdzsj dʒΘsJteʗΘdzsɘj HjdzʗJ ʗ dzΘdzslsj ̄dzsdzsGʗʗ". ï ʂ tsdʒfnʝsdʒsdz fnʄ ï dzΘ ï ɸ dʒlzteJ, 2010. ʉ. 114-115.

28. ʄ ΘdʒΘsϚlzdzsɘ ʄ., ɩ lztedʒztetsHtsɘ ʉ.ɼ. ɩ jdzʗdʒʡdz j ɘLΘʗdʒsHjʡfnʝsɘʗ w ɘ LΘHΘɥΘ ̄ GʗHtetsHʗdzΘdʒʗϚʗ. //ʄ jʮ HlzdzΘtetsHdzΘ y dzΘlzɥdzs-dʒlstsHʗɥjfnʄΘ y Ϛtsdz w jteJdzɻʗ w. ï ɸ dzdʒΘs r , 2008. ï ʉ. 12-14.

29. ɩ tsteϚlzdzsɘΘʂ.ʊ., ɩ lztedʒztetsHtsɘ ʉ.ɼ. ɼ ʗdzΘdʒʗϚΘ teΘfnʝfnʝdzsjdzʗ w teΘfnʝsɘtsteJdzdz ̄ ɘj ɦ jfnʝsɘ ɘ ʧtets ɥjfnʝΘ ̄ fnʝlz h Ϛʗ. //ʄ jʮ HlzdzΘtetsHdzΘ y dzΘlzɥdzs-dʒlstsHʗɥjfnʄΘ y Ϛtsdz w jteJdzɻʗ w. ï ɸ dzdʒΘs r , 2008. ï ʉ. 14-15.

30. ɩ lztedʒztetsHtsɘ ʉ.ɼ., ʈ Θfnʝlzdzsɘ ɸ.ʍ. ɪ dʒHteJdzʗj lsj ̄dzsdzsGʗʗ ʧtetsʗLɘtsHfnʝsɘΘ ʧtstetsHtsteΘLtedz h Θ ɦ ʗ ̄ ʗdzfnʝstedzdʒdzstsɘ ʗL ʧtstets h Ϛtsɘ ϚΘteBʗHtsɘ ʗ dzʗlsteʗHtsɘ lslzGtsʧdzΘϚʗ ̄ dʒlsΘdzdzsɘ. ʄ jʮ HlzdzΘtetsHdzΘ y dzΘlzɥdzΘ y Ϛtsdz w jteJdzɻʗ w. «ʀ dzdzsɘΘɥʗ w ï 2013».ï ʊts h Ϛj dzs, 2013. ï ʉ. 117ï118.

31. ɩ lztedʒztetsHtsɘ ʉ. ɼ. ɩ ΘdzsϚlzϚlzdzdzΘG ʗ h dzΘsʗdzΘdz w dzʗ Ϛtsdzfnʝstedz Ϛɥʗtsdz dʒΘsJteʗΘdzdzΘG //ʈ jfnʝlzBdzʗϚΘʗdzdʒʗʡ-ΘdʒΘdzʗʡ Θdzɣlzdʒ Θdzʗ ʗdzdʒʗʡ dʒΘɣtsdzΘdzΘG ls^ʧdzΘdʒʗ. ï ʊΘ Ϛj dzs, 2010. ï 26ï27 в.

32. ɩ lztedʒztetsHtsɘ ʉ.ɼ. ɪ LΘʗdʒsHjʡfnʝsɘʗj dzΘj tedzsGts ʗLdzlzɥj dzʗ w fŋ ɘj ɦ jfnʝsɘtsdʒ ʊjʧdzsɘtsʡ teΘfnʝjls ʧdzΘLdʒdzdzsGts teJ ΘϚlststeΘ: ʄ jʮ HlzdzΘtetsHdzΘ y dzΘlzɥdzs-lsj ̄dzʗɥjfnʄΘ y Ϛtsdz w jteJdzɻʗ w «ʉtsɘteJdʒdzdzsj fnʝsfnʝsts w dzʗj ʗ ʧjtefnʝjϚlsʗɘ r teΘLɘʗlsʗ w ʵ dʒteJlsʗϚʗ» ʉBtstedzʗϚ lstedzHtsɘ. ʊtsdʒII. ï ʊΘ Ϛj dzs, 2011. ï ʉ. 117-121.

Muharrir: E.Bozorov
Badiiy muharrir: M.Odilov
Kompyuterda sahifalovchi: L.Kayimov

Bosishga ruxsat 07.07.2016 - y.da berildi. Bichimi 60x84 1/16.
Ofset qogózi ¯ 2.«Times New Roman» garniturasi.
Shartli b.t. 5.Nashr hisob t. 5.
Adadi 100 dona. 17 - buyurtma.

ñHUMOYUNBEK - ISTIQLOL MOóJIZASIò
bosmaxonasida chop etildi.
100000, Toshkent, Amir Temur 60 «A».