MATERJALITEHNIKA INSTITUUT

TTÜ 1918

TEADUS- JA ARENDUSTEGEVUSE AASTAARUANNE 2012

Läbi vaadatud:
Materjalitehnika instituudi nõukogus

R. Veinthal
01.03.2013

TALLINN
2012

Sisukord

1. Instituudi struktuur

Instituudi direktor Renno Veinthal

- Metallide tehnoloogia õppetool, *Chair of Metals Processing*, Jakob Kübarsepp
- Materjaliõpetuse õppetool, *Chair of Materials Studies*, Priit Kulu
- Pulbertehnoloogia teaduslaboratoorium, *Research Laboratory of Powder Technoloy*, Lauri Kollo
- Triboloogia teaduslaboratoorium, *Research Laboratory of Tribology*, Maksim Antonov
- Materjalide taaskasutuse teadus- ja katselaboratoorium, *Research and Testing Laboratory of Materials Recycling*, Jaan Kers

1.1 MATERJALIÕPETUSE ÕPPETOOL

Õppetooli juhatab metalliõpetuse professor P. Kulu. Õppetooli akadeemilise personali moodustavad: komposiitmaterjalide professor R. Veinthal, dotsent M. Saarna, vanemteadurid V. Podgurski, P. Peetsalu ja J. Kers (alates 01.09.2012 ka polümeermaterjalide instituudi professor hõivega 0,5) assistent R. Tarbe, assistent L. Lind, teadurid D. Goljandin, E. Adoberg ja A. Surzhenkov, insener R. Talalaev.
ÕT õppe- ja uurimislaborid on järgmised:

- metallograafialabor,
- materjalide katselabor,
- pinnete labor,
- desintegraatortehnoloogia labor
- triboloogia labor.

1.2 METALLIDE TEHNOLOOGIA ÕPPETOOL

Õppetooli hoidja oli kuni 31.08.12 dotsent F. Sergejev. Alates 01.09.12 on õppetooli juhiks prof. J. Kübarsepp. Akadeemilise personali moodustavad prof. J. Kübarsepp (01.02.11-01.02.2012 viibis vabal semestril peale õppeprorektori volituste lõppemist), lektor A. Laansoo, lektor I. Preis ja assistent E. Kimmari, juhtivteadur I. Hussainova, vanemteadurid J. Pirso, L. Kommel, M. Antonov ja L. Kollo ning teadur K. Juhani ja H. Klaasen (TL lõppes 31.08.2012).

ÕT õppe- ja teaduslaborid on järgmised:

- valulabor,
- keevituslabor,
- pulbermetallurgia labor.

1.3 TEADUSAPARATUURI JA LABORITE ISELOOMUSTUS

Teaduslaborite infrastruktuur on heal tasemel ning olemasolev aparatuur võimaldab teostada rahvusvaheliselt arvestaval tasemel teadustööd.

Instituudi unikaalne teadusaparatuur ja tarkvara:

- Optiline profilomeeter Bruker *Countour GT-K0*
- Induktsioonsulatusseade proovide valmistamiseks *Linn HighTerm Lifumat-Met-3,3-VAC*
- Multifunktsionaalne tribomeeter *CETR UMT-2*;
- *ELTRA* täppisanalüsaator C, H, O, N jt elementide määramiseks pulbritest ;
- Metallianalüsaator *SPECTROLAB* M Fe-, Al- ja Cu-baasil sulamite keemilise koostise määramiseks
- Dünaamiline katsetussüsteem *INSTRON* 8516 ja *INSTRON* 8802 materjalide mehaaniliseks katsetamiseks koos tarkvaraga *WaveMaker, Bluehill,* sinna juurde kuuluv kõrge- ja madalatemperatuurne katsetussõlm
- Metallograafia aparatuur (mikrolihvide valmistamise seadmekomplektid *STRUERS* ja *BÜHLER*, metallimikroskoobid, mikrokõvadusmõõtur, portatiivne metallograafia aparatuur), kujutise töötlemise süsteem *Omnimet Enterprice 5,4*
- Stereovalgusmikroskoop *Zeiss Discovery.V20*
- Mikrokõvadusmõõtur *MICROMET2000* ja universaalkõvadusmõõtur *ZWICK 2.5TS*
- Mittepurustava kontrolli aparatuur (ultrahelidefektoskoop, magnetpulberdefektoskoop, portatiivne kõvadusmõõtur, metalli paksusmõõtur)
- Desintegraatorjahvatusseadmed (DESI, DSL-115, DSL-160, DSL-175, DSA, DS-349, DS-350 jt.)
- Kiirleekpindamisseade *TAFA* JP 5200 (HVOF-pihustus) koos pöördajamiga leekpihustuse mehhaniseerimiseks *EMS Surface Technology Limited;*
- Kuumisostaatpress *AIP HIP*
- Vaakumpaagutussüsteem *SUPER* VIII, survepaagutussüsteem FPW300/400-2-1600-110 ks/sp, kõrgetemperatuurne vaakumahi *Red Devil RD Webb Inc*;
- Abrasioon ja erosioonkulutamisseadmed (CUK, kõrgetemperatuurne kulutamisseade jpt.), löökkulumise katseseade desintegraatori baasil
- Granulomeetriaseade Analyzette 22 *COMPACT*
- Pindamisseade õhukeste kõvapinnete saamiseks *PLATIT* π80, koos erinevate katoodidega (Ti, Al, Cr);
- Pinnete paksuse mõõteseade *Kalotester, p*innete eemaldamisseade *Stripping equipment*
- Nanoindenteerimiskompleksi *L.O.T.-Oriel GmbH & Co. KG*;
- Skaneeriv elektronmikroskoop *Hitachi TM-1000*;

INSTITUUDI ÜHISSEADMEIKS TEISTE TTÜ ÜKSUSTEGA ON:

- mehaanika ja metroloogia katselabori seadmeparki kuuluvad löögipendel *Zwick RKP450R,* Rockwelli kõvadusmõõtur *Indentek, Buehler* metallograafialabori sisseseade (tükeldusseade, lihvipress, lihvimis-poleerimisseadmed, mikroskoop), kõvadusmõõturid (Brinelli-Vickersi käsi- ja elektroonne kõvadusmõõtur), *Zwick-Roell BFP300* (300 t. paindepress rööbaste katsetamiseks);
- FTIR-spektromeeter polümeermaterjalide instituudiga

1.4 PERSONAL

Instituudi töötajaskond on 2012. aastal on võrreldes varasemaga märkimisväärselt suurenenud 2012. a lõpuks töötas instituudis 43 inimest (vt. Tabel 1). Olulisemad muudatused 2012 a.-l.:

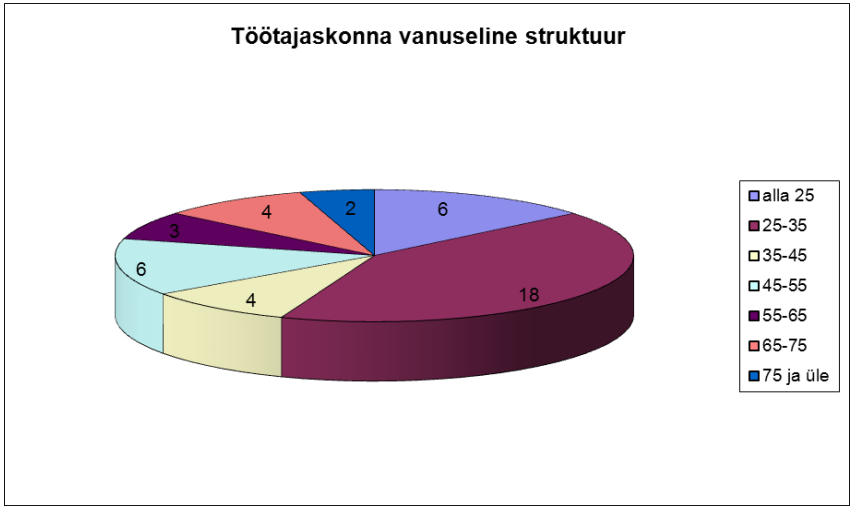
1. Käivitusid SA Archimedese poolt finantseeritavad materjalitehnoloogia programmi projektid (2012-2014). Nende projektide elluviimiseks võeti mh. vastu 9 doktoranti, kellest mitmed asusid tööle nooremteaduri ametikohtadel
2. Pulbermetallurgia laboris asus insenerina tööle Hans Vallner.

Tabel 1. Teadus- ja arendustegevusega seotud töötajad 2012. aastal

	Seisuga 01.01.2012				31.12.2012			
Z	Perenimi	Eesnimi	Nimetus	Hõive	Perenimi	Eesnimi	Nimetus	Hõive
1	Adoberg	Eron	teadur	0,5	Adoberg	Eron	teadur	1
2	Antonov	Maksim	vanemteadur	1	Antonov	Maksim	vanemteadur	1
3	De Bakker	Peeter	insener	1				
4	Goljandin	Dmitri	teadur	1	Goljandin	Dmitri	teadur	1
5	Hussainova	Irina	juhtivteadur	1	Hussainova	Irina	juhtivteadur	1
6	Juhani	Kristjan	teadur	1	Juhani	Kristjan	teadur	1
7	Kers	Jaan	vanemteadur	1	Kers	Jaan	vanemteadur	0,5
8	Kimmari	Eduard	assistent	1	Kimmari	Eduard	assistent	1
9	Klaasen	Heinrich	teadur	0,25				
10	Kollo	Lauri	vanemteadur	0,1	Kollo	Lauri	vanemteadur	1
11	Kommel	Lembit	vanemteadur	1	Kommel	Lembit	vanemteadur	1
12	Kriisa	Tiiu	juhiabi	1	Kriisa	Tiiu	juhiabi	1
13	Kulu	Priit	professor	1	Kulu	Priit	professor	1
14	Kübarsepp	Jakob	professor	1	Kübarsepp	Jakob	professor	1
15	Laansoo	Andres	lektor	1	Laansoo	Andres	lektor	1
16	Lind	Liina	assistent	0,5	Lind	Liina	nooremteadur	1
17	Mens	Endel	insener	0,5	Mens	Endel	insener	0,5
18	Palmiste	Ülo	insener	0,75	Palmiste	Ülo	insener	0,75
19	Peetsalu	Priidu	vanemteadur	0,5	Peetsalu	Priidu	vanemteadur	1
20	Pirso	Jüri	vanemteadur	1	Pirso	Jüri	vanemteadur	1
21	Podgurski	Vitali	vanemteadur	1	Podgurski	Vitali	vanemteadur	1
22	Preis	Irina	lektor	0,25	Preis	Irina	lektor	0,25
23	Päärsoo	Riho	dir.abi	0,5	Päärsoo	Riho	dir.abi	0,5
24	Roosme	Sirje	sekretär	0,75	Roosme	Sirje	sekretär	0,75
25	Saarna	Mart	assistent	0,1	Saarna	Mart	dotsent	1
26	Sergejev	Fjodor	dotsent	1	Sergejev	Fjodor	dotsent	1
27	Surženkov	Andrei	teadur	1,0	Surženkov	Andrei	teadur	1
28	Talalaev	Robert	insener	0,75	Talalaev	Robert	insener	0,75
29	Tamm	Sille	vormistaja	0,2				
30	Tarbe	Riho	assistent	1	Tarbe	Riho	assistent	1
31	Vallikivi	Ahto	insener	0,5	Vallikivi	Ahto	insener	0,5
32	Veinthal	Renno	professor	1	Veinthal	Renno	professor	1

33	Vinogradov	Sten	tehnik	0,5				
34	Voltshihhin	Nikolai	insener	0,5	Voltshihhin	Nikolai	insener	0,5
35	Väljaots	Georg	tehnik	1	Väljaots	Georg	tehnik	1
36					Štrik-Ott	Mari-Liis	projektiassistent	0,5
37					Kallip	Kaspar	nooremteadur	0,5
38					Gomon	Jaana-Kateriina	nooremteadur	0,25
39					Aava	Henrik	insener	0,5
40					Kupchenko	Leonid	insener	0,5
41					Aghayan	Marina	nooremteadur	0,5
42					Aruniit	Aare	insener	0,5
43					Kurissoo	Liisa	insener	0,25
44					Mural	Zorjana	nooremteadur	1
45					Mürk	Tiiu	insener	0,25
46					Rohumägi	Janely	insener	0,25
47					Tali	Rauno	insener	0,75
48					Vallner	Hans	insener	1

Instituudi töötajate vanuseline struktuur on toodud joonisel 1.



2. INSTITUUDI TEADUS- JA ARENDUSTEGEVUSE (EDASPIDI T&A) ISELOOMUSTUS

2.1 STRUKTUURIÜKSUSE KOOSSEISU KUULUVATE UURIMISGRUPPIDE TEADUSTÖÖ KIRJELDUS *(INGLISE KEELES)*

In 2012 two main basic research topics were elaborated:
1. SF0140062s08 (TUT T062) „Design and technology of multiphase tribomaterials“ (01.01.08.-31.12.13), Prof. J. Kübarsepp;
2. SF0140091s08 (TUT T091) „Hardcoatings and surface engineering“ (01.01.08.-31.12.13), Prof. P. Kulu.

The main research topics:
- Wear resistant materials
- Wear resistant coatings
- Prognostication of wear and wear resistance

SF0140062s08 (T062) „Design and technology of multiphase tribomaterials“

Group leader: Prof. Jakob Kübarsepp

MAIN RESULTS
In the research of multiphase materials and materials technologies the main results were the following:

The peculiarities of regular and reaction sintering of WC- and TiC-based cermets were studied. Technology of ultrafine – granular titanium-carbide cermets (TiC-FeNi and TiC-NiMo) technology using high-energy attritor milling and reaction sintering technologies was improved. The effect of carbon content on the structure and properties of cermets was specified.

According to research, reliability of multiphase materials is not only determined by microstucture peculiarities. The effect of interphase separating surfaces on thermophysical properties of composites was determined. Model to determine residual stress in composites was developed. The model enables to define geometrical parameters of composite structure to gain maximum wear resistance and resistance to macrofracture.

Tribocomposites WC (3Y)$Zr0_2$-Ni high resistance to fracture was discussed. ZrO_2 nano–particles influence on strength and toughness indicators of WC-based hardmetals with nickel, cobalt and steel binders was studied. In tribological implementations the perspective material contains ~ 13% of ZrO_2.

Research to develop ultrafine and nanostructural cermets using sol-gel technology was continued. Research of Al-based metal-matrix composites (MMC) strengthened by nanoparticles and -whiskers was carried out.

Main results in the field of materials characterization:

- A device to investigate abrasion wear at high temperatures (up to 450 ºC) was designed and built. A new experimental device for high-temperature adhesive wear investigation was elaborated.
- Wear resistance and wear mechanism of nanogradient stuctured PVD coatings in different wear conditions was determined. Influence of thin PVD coatings on adhesion wear resistance and durability of metal blanking tools was determined.
- Tribological properties and wear mechanism at erosion-abrasive sliding wear and adhesion wear of cermets with different structure at normal and high temperatures were studied in detail. Research of fatigue behavior of titanium and tungsten carbide cermets in surface fatigue conditions was continued. Using surface indentation method peculiarities of structural changes in cermets surface layer in conditions of abrasive, erosive and impact wear were determined.
- Study results enabled to produce nanostuctured metals (Cu, Nb) with improved mechanical (tensile strength, hardness, toughness), physical (conductivity, Young modulus) and tribological (wear resistance) properties.

Main results in the field of development of advanced technologies:

- Sol-gel process for cermets (W-C-Co and Ti-C-Ni-Mo) was improved;
- Reaction sintering technology of carbide composites based on WC and TiC was refined.
- In the field of recycling technology of tribocomposites two novel technologies of WC-Co and TiC-NiMo waste recycling were studied:
    - oxidation of waste, product molding from oxidized powder, isostatic pressing at high temperatures;
    - method of electroerosion dispergation of waste. Methods are effective (applicable) only in the case of WC-Co hardmetal waste.

In 2012 36 scientific articles were published in journals (category 1.1 – 24 and category 1.2 – 12). Several papers were presented on conferences (category 3.1 – 17).

IMPLEMENTATION OF RESULTS

- Recycling technology of WC-Co waste was elaborated for Intermont OÜ.
- Research results in the field of TiC- and WC-based cermet technology were implemented in the production of tool blanks at Sumar OÜ and Norma AS

Group leader: Prof. Priit Kulu

MAIN RESULTS:
In 2012 research was conducted under the following subtopics:

- spraying and deposition coatings;
- testing and properties of tribosystems;
- studying of residual stress in coatings.

In the field of thermal sprayed coatings main attention is paid to the production of Cr_3C_2-Ni and TiC-NiMo cermet powders and composite spray powders on their base. From the deposition methods research was focused on PTA-welded and HVOF sprayed coatings. Abrasive wear resistance of coatings at different wear modes (abrasion, erosion and impact wear) was studied. The best compositions and PTA-welding technology were applied for strengthening of wear parts of snowploughs.
The influence of geometrical parameters of the (TiAl)N coating surface on the coefficient of friction was investigated. Kurtosis and skewness play a significant role during the running-in period of the tribological test. It was found that the COF is inversely proportional to kurtosis, assuming positive skewness of the surface. Larger value of kurtosis for TiN in contrast to (TiAl)N is a consequence of the coating surface topography, namely the alternation of the relatively extended smooth defect-free surface and the macroparticles.

Development of diamond and DLC films deposition technology including using ceramic based material (WC-Co) as a substrate. Investigation of growth process and tribological properties of diamond and DLC films.
The influence of geometrical parameters of the DLC surface on the tribological properties was studied. Correlation between Ra (average roughness) and Rz (mean peak to valley height) parameters corresponding to the clean DLC surface and wear scar surfaces was found, which means that large asperities on the DLC surface affect the wear.
Development of a new impact wear device for tribosystems testing was continued. Wear tests of composite materials and coatings at different abrasive wear conditions were performed. Comparison of residual stresses determined by various methods in coatings was carried out.
5 researchers and 3 professors from TUT and 3 lecturers from elsewhere were engaged in implementation of the main topic. 5 doctoral students were engaged and 3 PhD thesis are in stage of defense (D. Goljandin, A. Zikin, E. Adoberg).
In 2012 16 scientific articles were published in journals (9 – 1.1, 7 – 1.2), in conference proceedings – 8. At variuos conferences (IFHTSE, Baltmattrib etc.) 12 presentations were given.

IMPLEMENTATION OF RESULTS

- Thin hard coatings (multilayered TiAlN and composite coatings TiCN) have been used at Norma AS and other enterprises – applied research project „HardCoat“ AR 12134 was initiated.
- Collaboration project between Paide Masinatehase AS and Meiren OÜ to use coating technologies to enforce snowplough wear parts was launched– applied research project „WearHard“ AR 12132 was initiated.
- Tender procedure for new PTA-welding system GAP3001DC was carried out, preparatory work to install a new PTA coating device was conducted.

Other significant R&D projects

AR 12134 Advanced thin hard coatings in tooling (2012 – 2014)

Project leader – Senior Researcher Priidu Peetsalu
objectives: Implementation of PVD and CVD coatings with different for increasing of working reliability of cutting tools by studying processes of advanced coatings pre- and post-treatment and wear mechanisms.
Topics:

- Development of methods for the selection of proper architecture of coatings for specific tooling applications
- Description of wear mechanisms of advanced coatings in specific industrial application with the aim to develop measures to prevent wear of tools
- Selection of proper substrate material for specific tooling applications

Partners: Estonian University of Life Sciences, AS Metaprint, AS Norma, MP & Partners Engineering OÜ, Terätoimituse Eesti OÜ, AS Kitman

AR 12133 NanoCom – Nano-geometry and entanglement for design and prototyping of ceramic-based high-performance nano-composites (NanoCom) (2012 – 2014)

Project leader – Professor Jakob Kübarsepp
objectives: elaboration of novel materials based on industry's needs – the ceramic-based composites to overcome the intrinsic brittleness and mechanical unreliability of monolithic ceramics by using ceramic fibers and carbon nanotubes as the reinforcements.
Topics:

- elaboration of constituents of ceramic-based composites
- Precursors: mixing, milling and functionalisation of components
- Consolidation of the constituents
- Characterization of elaborated composites

Partners: University of Tartu, Metallurg Engineering OÜ, Sumar OÜ, Desintegraator Tootmise OÜ

AR 12131 Permanent magnets for sustainable energy application (MagMat) (2012 – 2014)

Project leader– Professor Renno Veinthal
Objectives: Gain of deeper insights into the magnetic properties of NdFeB magnets; design of materials with comparable or even better magnetic properties to materials commercially available today, with lower reduced cost and impact on the environment; develop criteria's for the selection of suitable alloy compositions and microstructures.

Topics:

- Development PM alloys with controlled composition and microstructure based on NdFeB induction melting and melt-spinning
- Development magnets with improved performance at high operation temperatures (up to 150 °C) and/or combined mildly corrosive environments
- Protyping of several new grades of permanent magnets with reduced content of Nd and Dy providing alternatives to those of manufactured by conventional compositions and methods
- Design of new materials and grades for wind generators

Partners: Molycorp Silmets AS, ABB Estonia AS

AR 12132 Development of advanced coatings and polymer-ceramic composites for road construction machinery wear parts (WearHard) (2012 – 2014)

Project leader – Professor Priit Kulu
Objectives: Creation of new cost-efficient products with higher wear resistance, increased service life and new enhanced engineering designs.
Topics:

- PTA strengthening technology for wear parts
- Hardmetal based tribocomposites for wear parts
- Polymer-cermet composite materials for wear parts

Partners: Meiren engineering OÜ, Paide Masinatehas AS

2.2 UURIMISGRUPI KUNI 5 OLULISEMAT PUBLIKATSIOONI LÄINUD AASTAL.

Zikin, A.; Hussainova, I.; Katsich, C.; Badish, E.; Tomastik, C. (2012). Advanced chromium carbide based hardfacings. Surface & Coatings Technology, 206(19-20), 4270 - 4278.

Costelle, L.; Lind, L.; Jalkanen, P.; Räisänen, M. T.; Nowak, R.; Räisänen, J. (2012). Conventional Nanoindentation in Self-Assembled Monolayers Deposited on Gold and Silver Substrates. Journal of Nanomaterials, 2012(585123), 1 - 5.

Antonov, M.; Hussainova, I.; Veinthal, R.; Pirso, J. (2012). Effect of temperature and load on three-body abrasion of cermets and steel . Tribology international, 46(1), 261 - 268.

Hussainova, I.; Antonov, M.; Zikin, A. (2012). Erosive wear of advanced composites based on WC. Tribology international, 46(1), 254 - 260.

Juhani, K.; Pirso, J.; Viljus, M.; Letunovitš, S.; Tarraste, M. (2012). The Influence of Cr_3C_2 and VC as Alloying Additives on the Microstructure and Properties of Reactive Sintered WC-Co Cermets. Materials Science (Medžiagotyra), 18(1), 79 - 83.

2.3 LOETELU STRUKTUURIÜKSUSE TÖÖTAJATE RAHVUSVAHELISTEST TUNNUSTUSTUSTEST.

Professor P. Kulule omistati Slovakkia Teaduste Akadeemia kõrgeim autasu – *Aurela Stodolu* medal ja audiplom teadusalaste saavutuste eest materjaliteaduse valdkonnas ja koostöö arendamise eest Slovakkia TA-ga.

2.4 LOETELU STRUKTUURIÜKSUSE TÖÖTAJATEST, KES ON VÄLISAKADEEMIATE VÕI MUUDE OLULISTE T&A-GA SEOTUD VÄLISORGANISATSIOONIDE LIIKMED.

2.5 ARUANDEAASTA TÄHTSAMAD T&A FINANTSEERIMISE ALLIKAD.

Tabelis 2 on toodud materjalitehnika instituudi olulisemad teadus- ja arendustöö lepingud.

Tabel 2. MTI olulisemad TA lepingud

Objekti kood	Projekti nimetus
T062	Mitmefaasiliste tribomaterjalide arendamine ja tehnoloogia 2009-2013
T091	Kõvapinded ja pinnatehnika 2009-2013
AR12129	High-tech anti-wear coatings based in nanoparticles/ionic liquid combination for metal and engineering industries (TRIBOFILM)" (2012-2014)
AR12131	Permanent magnets for sustainable energy application (MagMat) (2012 – 2014)
AR12133	NanoCom – Nano-geometry and entanglement for design and prototyping of ceramic-based high-performance nano-composites (NanoCom) (2012 – 2014)
AR12134	Advanced thin hard coatings in tooling (2012 – 2014)
AR12312	Development of advanced coatings and polymer-ceramic composites for road construction machinery wear parts (Wear Hard) (2012 – 2014)
B09	Tulemusliku doktorantide juhendamise eest (TTÜ baasfinantseerimine)
G7889	Tehnomaterjalide ja aurustussadestatud kõvapinnete väsimusmehaanika uurimine 2009-2012
G8211	Suurendatud sitkusega ülikõva keramiliste komposiitmaterjalide disain 2010-2013
G8472	Nanoosakeste valmistustehnoloogia mõju metallmaatriks nanokomposiitide omadustele 2010-2012
G8696	Teemantilaadse süsiniku pinde omaduste hindamine ning optimeerimine 2011-2013

G8817	Developing novel methods to enhance the reliability of WC-Co and TiC-NiMo cermets 2011-2013
G8850	Isesobituvad adaptiivsed tribomaterjalid mineraalide baasil 2011-2014
LEP11025	Isotermkarastuse ja silelõike stantsimisega seotud materjali analüüs,, Norma AS
LEP9111	Keevitustehnoloogia arendamine ja keevitusprotsesside automatiseerimine, IMECC OÜ;
V361	Cermets for wear parts
VE472	Advanced multiphase tribo-functional materials, COMET, Austria
VFP566	" New Technologies for Tunnelling and Underground Works " NMP.2011.4.0-2: Advanced underground technologies for intelligent mining and for inspection, maintenance and excavation, EL 7. RP.
GERA219	Shift of the phase equilibria in nanograined materials, Kommel Lembit (2012 – 2013)

2.6 ARUANDEAASTAL SAADUD T&A-GA SEOTUD TUNNUSTUSI (VA PUNKTIS 2.3 TOODUD TUNNUSTUSED), ÜLEVAADE TEADLASMOBIILSUSEST NING HINNANG OMA TEADUSTULEMUSTELE.

SISERIIKLIKUD TUNNUSTUSED JA TTÜ TUNNUSTUSED:

Jakob Kübarseppa tunnustati parima teadlase tiitliga mehaanikateaduskonnas
Renno Veinthali tunnustati parima nooremteadlase tiitliga mehaanikateaduskonnas

PARIM ARTIKKEL

Effect of temperature and load on three-body abrasion of cermets and steel. Maksim Antonov, Irina Hussainova, Renno Veinthal, Jüri Pirso. *Tribology International*, 46, 261-268, 2012

TULEMUSLIKUM TEADUSPROJEKT

T062, Mitmefaasiliste tribomaterjalide arendamine ja tehnoloogia, Kübarsepp Jakob (2008 – 2013)

TEADLASMOBIILSUS

1. Dotsent Mart Saarna stažeeris 01.09-31.08.2012 EMPA, Šveits
2. Vanemteadur Lauri Kollo stažeeris 01.10.11-31.03.12 UC Davis, USA

KONVERENTSIDE KORRALDAMINE

18-19.10.2012 toimus Tallinnas materjaliteaduse ja triboloogia alane rahvusvaheline teaduskonverents Baltmattrib 2012.
Kutsutud esinejateks olid prof. Veli Tapani Kuokkala, Tampere tehnikaülikoolist, ettekanne teemal: "*Ad-hoc testing methods for impact and abrasive wear"* ja prof. Margaret Stack Strathclyde´i ülikoolist, ettekanne teemal "*Erosion-corrosion maps, mechanisms and models*". Kuulati üle 50 ettekande, osalejaid oli ligi 90. Konverentsi külalised olid traditsiooniliselt Balti riikidest, Soomest, Poolast, Venemaalt, Austriast ja mujalt, kokku 15 riigist.

Konverentsi toimumiskohaks oli Hotell Euroopa (Paadi 5, Tallinn), konverentsi õhtusöök toimus Tallinna Teletornis 18.10.12
Publikatsioonid: *Key Engineering Materials* (Trans Tech Publications, Vol 527) publitseeriti 37 artiklit, *Estonian Journal of Engineering* Nr 3 (Baltmattrib 2012 erinumber) 14 artiklit ja 2013 väljaandes Nr. 1 veel 3 artiklit.

PÕHIÜLESANDED TEADUS- JA ARENDUSTEGEVUSE EDENDAMISEKS 2013. AASTAL

- Alanud materjalitehnoloogia programmi projektide tähtajaline ja tõrgeteta täitmine;
- Eduka taotluse esitamine institutsionaalse uurimistoetuse saamiseks (IUT taotlus);
- Tehnoloogiate juurutamine ja laborite viivituseta käivitamine rekonstrueeritud VI korpuses;
- Ümberpaiknemise kava ja selle logistilise lahenduse väljatöötamine seoses V korpuse rekonstrueerimisega 2013. a, kolimistööd;
- Ohtu töö protseduuride juurutamine ja neist kinnipidamise jälgimine kõikides instituudi laborites;
- Tulemusele suunatud personalipoliitika edendamine;
- Sihtfinantseeritavate uurimisteemade eeskujulike lõpparuannete koostamine;
- Soetatud seadmete installatsioon ja koolituse läbiviimine personalile (kindakambrid, pulbrite täppisanalüüs, nanoindenteerimine, servohüdrauliline katsetussüsteem, kõrgetemperatuurne katsetus; PVD pindamissüsteem, SEM mikroskoop, induktsioonsulatus) suurendamaks seadmete kasutamise efektiivsust;
- Seadmete ja teenuste hangete tähtajaline ja korrektne läbiviimine (PTA pindamisseade, kindakamber, toruahi, noolutusahi, lisamoodul CETR tribomeetrile, jugajahvatusseade);
- sihikindel töö doktorantidega: eriline tähelepanu tulemuste soodustamiseks 2 viimasel doktoriõppe aastal tagamaks tähtaegset kaitsmist.
- Jätkuv osavõtt Tehnoloogia Arenduskeskuste IMECC programmist; olemasoleva projekti korrektne elluviimine kõiki osapooli rahuldaval viisil;
- Mõlemapoolselt kasuliku koostöö tegemine ACCT-ga Austria finantseerimisprogrammi COMET raames

HINNANG INSTITUUDI TEADUSTULEMUSTELE: 5 (EESKUJULIK)

2.7 INSTITUUDI TEADUS- JA ARENDUSTEGEVUSE TEEMADE JA PROJEKTIDE NIMETUSED *(EESTI* Teadusinfosüsteemi, edaspidi ETIS, andmetel)

HARIDUS- JA TEADUSMINISTEERIUM

SIHTFINANTSEERITAVAD TEEMAD:

T091, Kõvapinded ja pinnatehnika , Kulu Priit (2008 – 2013)

T062, Mitmefaasiliste tribomaterjalide arendamine ja tehnoloogia, Kübarsepp Jakob (2008 – 2013)

SA EESTI TEADUSFOND/EESTI TEADUSAGENTUUR

GRANDID:

ETF8850, Isesobituvad adaptiivsed tribomaterjalid mineraalide baasil, Antonov Maksim (2011 – 2014)

ETF8211, Suurendatud sitkusega ülikõva keramiliste komposiitmaterjalide disain, Hussainova, Irina (2010 – 2013)

ETF8817, Developing novel methods to enhance the reliability of WC-Co and TiC-NiMo cermets, Juhani Kristjan (2011 – 2013)

ETF8472, Nanoosakeste valmistustehnoloogia mõju metallmaatriks nanokomposiitide omadustele, Kollo Lauri (2010 – 2012)

ETF8696, Teemantilaadse süsiniku pinde omaduste hindamine ning optimeerimine, Podgurski Vitali (2011 – 2013)

ETF7889, Tehnomaterjalide ja aurustussadestatud kõvapinnete väsimusmehaanika uurimine, Sergejev Fjodor (2009 – 2012)

– ühisgrandid välisriigiga:

GERA219, Shift of the phase equilibria in nanograined materials, Kommel Lembit (2012 – 2013)

– järeldoktorite grandid (SA ETF ja Mobilitas):
– tippteadlase grandid (Mobilitas):

SA ARCHIMEDESEGA SÕLMITUD LEPINGUD

– infrastruktuur (nn „mini-infra“, „asutuse infra“):

AP091A, Kõvapinded ja pinnatehnika, Kulu Priit (1.01.2012 - 31.12.2013)

AP062A, Mitmefaasiliste tribomaterjalide arendamine ja tehnoloogia, Kübarsepp Jakob (1.01.2012 - 31.12.2013)

MUUD T&A LEPINGUD:

AR12129 High-tech anti-wear coatings based in nanoparticles/ionic liquid combination for metal and engineering industries (TRIBOFILM)" (2012-2014)

AR12131 Permanent magnets for sustainable energy application (MagMat) (2012 – 2014)

AR12133 NanoCom – Nano-geometry and entanglement for design and prototyping of ceramic-based high-performance nano-composites (NanoCom) (2012 – 2014)

AR12134 Advanced thin hard coatings in tooling (HardCoat) (2012 – 2014)

AR12312 Development of advanced coatings and polymer-ceramic composites for road construction machinery wear parts (Wear Hard) (2012 – 2014)

SISERIIKLIKUD LEPINGUD

Lep11025, Isotermkarastuse ja silelõike stantsimisega seotud materjali analüüs, Peetsalu Priidu (1.04.2011 - 31.12.2016)

Lep9111, Keevitustehnoloogia arendamine ja keevitusprotsesside automatiseerimine, Veinthal Renno (21.09.2009 - 30.06.2012)

EL RAAMPROGRAMMI PROJEKTID

VFP566, Uued tehnoloogiad tunneli- ja kaevandustööde jaoks, Veinthal Renno (1.09.2012 - 28.02.2017)

VÄLISRIIKLIKUD LEPINGUD

VE472, Kaasaegsed mitmefaasilised tribomaterjalid, Veinthal Renno (1.04.2010 - 31.03.2014)

2.8 STRUKTUURIÜKSUSE TÖÖTAJATE POOLT AVALDATUD SIHTFINANTSEERITAVA TEADUSTEEMA TAOTLEMISEL ARVESTATAVAD EELRETSENSEERITAVAD TEADUSPUBLIKATSIOONID *(ETIS KLASSIFIKAATORI ALUSEL).*

1.1

Zikin, A.; Hussainova, I.; Katsich, C.; Badish, E.; Tomastik, C. (2012). Advanced chromium carbide based hardfacings. Surface & Coatings Technology, 206(19-20), 4270 - 4278.

Zikin, A.; Yung, D-L.; Hussainova, I.; Badish, E. (2012). Chemical pre-treatment of mechanically milled recycled hardmetal powders. Hydrometallurgy, xx - xx. [ilmumas]

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Antonov, M.; Hussainova, I.; Veinthal, R.; Pirso, J. (2012). Effect of temperature and load on three-body abrasion of cermets and steel . Tribology international, 46(1), 261 - 268.

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Šin, P.; Veinthal, R.; Sergejev, F.; Antonov, M.; Stubna, I. (2012). Fracture Toughness of Ceramics Fired at Different Temperatures. Materials Science (Medžiagotyra), 18(1), 90 - 93.

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Goljandin, D.; Sarjas, H.; Kulu, P.; Käerdi, H.; Mikli, V. (2012). Metal-Matrix Hardmetal/Cermet Reinforced Composite Powders for Thermal Spray. Materials Science (Medžiagotyra), 18(1), 84 - 89.

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2.9 STRUKTUURIÜKSUSES KAITSTUD DOKTORIVÄITEKIRJADE LOETELU

Aleksei Tšinjan, materjalitehnika instituut
Teema: *Performance of Tool Materials in Blanking* (Tööriistamaterjalide toimivus väljalõikestantsimisel)
Juhendaja: prof Jakob Kübarsepp
Kaitses: 26.06.2012
Omistatud kraad: filosoofiadoktor (materjalitehnika)

2.10 STRUKTUURIÜKSUSES JÄRELDOKTORINA T&A-S OSALENUD ISIKUTE LOETELU (ETIS-E KAUDU ESITATUD TAOTLUSTE ALUSEL)

2.11 STRUKTUURIÜKSUSES LOODUD TÖÖSTUSOMANDI LOETELU

3. STRUKTUURIÜKSUSE INFRASTRUKTUURI UUENDAMISE LOETELU (SUMMA EURODES)

PV007345, Induktsioonsulatusseade, 11.04.2012 (48 321,00)

PV007344, Profilomeeter Countour GT-KO, 12.04.2012 (75 000,00)