

## Editorial

Dear Members,

After the success of our first Newsletter, here is the second one, dealing with the last achievements in EXCELL and VINF.

In 2008, this Newsletter should be published more regularly, we hope once every second month. As before, all your comments and suggestions are welcome to improve the quality of the document.

Enjoy your reading!

Sincerely yours,

F. Mirabella and M. Haïdopoulo.

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## HIGHLIGHTS

### First International Conference on Functional Nanocoatings

Budapest CRC-HAS, March 30- April 2 2008

[www.chemres.hu/nanocoatings](http://www.chemres.hu/nanocoatings)

#### Important deadlines:

Registration: 15 of December 2007

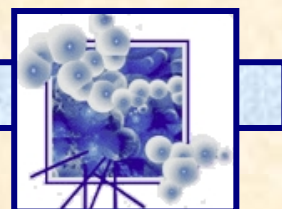
Early bird payment: 16 of December 2007

Submission of abstract: 15 of December 2007



All members are invited to submit their work for oral or poster sessions and to diffuse the information all around. Emphasis will also be put on technological transfers between academic researchers and industrial participants during the Technological Transfer (TT) day on Wednesday 2<sup>nd</sup> April (pm). It will be based on round table discussions to answer to the following question: How can advanced nanocoating systems meet the challenges of different industries?





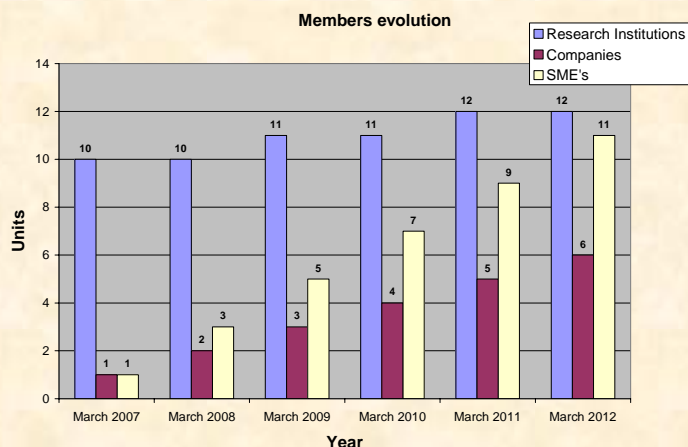
### EXCELL School in Haifa - Technion - November 2-9 2007



The training course on Microstructure, Characterization of Nanostructured Films and Coatings was held in Haifa (Israel) for 8 days. The students attended lectures covering the various subjects including electron microscopies, electronic spectroscopies, and optical spectroscopies, near field microscopy... 15 students from 8 EXCELL partners participated to this successful school.

### Business Plan

The new version of the business plan is to be delivered to the EC. Running costs of our Association should reach 121.000 € per year in 2010 in beyond. First estimation of possible revenues through technical services, training, conference organisation and research projects coordination reach more or less 100.000 € per year. Some solutions have to be found to find the extra 21.000 € needed. Equivalent cost reduction seems to be more difficult to reach without changing the Association business model. Among other things, the financial scenario stands on an evolution of VINF number of members as presented in the here right chart. Welcoming more members to have 21.000 € more membership is far for being unrealistic. For sure the Budapest conference will allows evaluating the motivation for new Institutions to join VINF and to test hypotheses our Business plan stands on.



### New co-manager in the EXCELL team: Marie Haïdopoulo

Marie Haïdopoulo was newly hired by ArcelorMittal in the R&D research centre in Liège (Belgium) and will be entirely dedicated to EXCELL management and VINF development. In 2005, Marie finished a PhD thesis on surface treatments and plasma polymerization on stainless steel for endovascular applications at Laval University (Québec - Canada). Then, she worked for almost 3 years as a post-doctoral researcher at University of Namur (Belgium) on smart coatings deposition by RF plasma.

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## Information Technology (IT) issue

During the last Global Meeting in Haifa, some few partners expressed their problems with the EXCELL portal, in terms of loading speed and connections. SHS team will solve these problems individually beginning by the case of CRC-HAS in the beginning of December.

## EXCELL Participation to ICMCTF - San Diego (CA-USA) - April 28-May 2 2008

(<https://www2.avs.org/conferences/icmctf/>)



EXCELL people will take part in the 35<sup>TH</sup> INTERNATIONAL CONFERENCE ON METALLURGICAL COATINGS AND THIN FILMS (ICMCTF-2008): Dr. Irena Gotman (Technion - Israel Institute of Technology, Haifa, Israel) as an Invited speaker will give a talk titled "Surface Functionalization of Surgical Implants for Cell Guidance and Control" and Prof. Dmitry Shtansky (State Technological University "Moscow Institute of Steel and Alloys) will be present as a Symposium Chairman.

They will be active in the symposium topic n°3 called "Bioactive coatings and surface biofunctionalization" of which the scope is defined as: "Bioactive and biocompatible coatings and biofunctionalization of surfaces for biomaterials and biomedical applications form the key focus of this symposium. The main function of such coatings and surfaces is to elicit and regulate specific functions in biological systems. Papers are solicited in areas related to: bioactive and biocompatible coatings for orthopedic and dental implants, cardio-vascular stents, drug delivery and biosensing; hydroxyapatite coatings; biomimetic and bio-inspired coatings; anti-bacterial and anti-biofouling coatings; biofunctionalization of materials surfaces such as tissue engineering scaffolds by wet chemical and plasma methods; cell-surface interactions; bio-lubrication and bio-tribology; and processing and characterization of biomaterial surfaces. A special round-table discussion involving all the interested researchers is also envisaged for discussing topics of special interest for possible inclusion in the ICMCTF2009 program."



### VINF Registration by Royal Decree

The VINF International non profit association with scientific purpose was officially registered by the Belgium Ministry of Justice through a Royal decree signed on the 25<sup>th</sup> of October 2007 (registration n° 0893.523.022).

### NoE Workshop EC in Brussels - November 29 - 2007

The third Network of Excellence workshop organized by the European Commission was held in Brussels on the 29<sup>th</sup> of November. Frédéric Mirabella, Marie Haïdopoulo, Hélène de Rode, and Martyn Chamberlain were present among the other NoE coordinators and scientific officers.

The program was focused on Durable Integrated Structure (DIS) documents in terms of the operational rules regulating durability, the operation of the promised integration (RRM, Infrastructures, Education, Commercial Services), and resource allocation. The other NoEs present were: METAMORPHOSE, MIND, KMM, MAGMANET, FAME, NANOFUN-POLY, SOFTCOMP. Very different systems were set up. For instance, some NoEs promoted science and absolutely no business (SOFTCOMP), some focused strongly on the development of the educational part (META), or some were more industry oriented with only some few universities in the network (MIND).

A talk was made by Frédéric about VINF operational rules defined by statutes and bylaws. Positive comments from the others NoEs' were made in particular about the article 16 of the bylaws describing the "malus-bonus" system applied to choose which members will provide services in case of equal competences and costs for a similar service. However, the EXCELL partners are encouraged to increase the number of durable integrated activities that was judged rather low compared to the other NoEs. Moreover, as a quote from the Organisers, we will remind that NoEs which have extensive regulation articles (Statutes, Bylaws, Consortium Agreements...) are "sitting on gold". Looking at our situation in EXCELL, let's consider we are sitting on silver! However EXCELL distinguishes from the other NoEs by two very important factors:

1. We still have 2 years in front of us while some other NoEs finish their funded phase earlier (some already in May 2008!). This is explained by the fact that EXCELL started later but also because EXCELL get 5 years funding while the most others get money for 4 years.
2. EXCELL is not the largest, nor the smaller consortium. But if we balance the money we received from EC by the number of partners, we are among the richer if not the richest.

From our point of view, this obliges us to be the best. This means succeeding where the other succeeded and even where they failed. One step has been made in this sense thank to the FP7





project we already had. Only 3 FP7 projects were numbered in the audience. No small project, nor integrated project (raising lots of comments and questioning towards the EC authorities).

NoE's coordinators addressed to EC a set of question concerning their possible support of NoEs in FP7 proposals. Typical questions were:

- We want Virtual Institute to submit a proposal as sole partner, is it possible?
- We want Virtual Institute to be coordinator but we can't provide financial guarantee, is any solution possible?
- It is a pity the consortium is not taking into account at stage 1. Maybe some evaluators are not aware of NoEs and rejected proposals because they didn't understand what NoEs are. EC should give clear instruction to evaluators concerning NoEs.

The global answer from EC side was that NoEs are "new animals" and that they are now considering their involvement in FP proposal case by case. Maybe rules shall be adapted to consider NoEs but it needs to be discussed inside the EC first. Another important answer was that any institution has to convince of their ability to execute the foreseen tasks. "Saying, we are Siemens and we now how to do is not acceptable at all. Even if you are Siemens, you have to explain how you will do the job and convince you are really able to". This quote from EC was also addressed to VINF. It is very important to inform the evaluators in the proposal of who we are and to prove our value...

### Set-up of the Integrated Master Program

During the last Global Meeting in Haifa, last developments about the integrated teaching Program were discussed, based on information and proposals brought by Asuncion Fernandez Camacho. It has been decided to set-up a Post-graduate program for PhD students which will be the basis of an Advanced Master Program. The only difference between both will be the official recognition of ECTS credits which are stricter for Master with respect to PhD school.

The program should be divided into 5 modules including deposition, characterization, mechanical applications, biological applications, and fundamentals. EXCELL partners will host the different modules. Places and module agenda will be decided at next EXCELL Global Meeting in April 2008.

### VINF Logo



A new logo for VINF was proposed by an Art School in Lille (France) and we would like today to have your opinion about it. Any comment, suggestion (or any other proposal) will be more than welcome. It is urgent to take a decision concerning this logo, in order to use it for any VINF official form and also to make it appearing on the VINF website.



### Prof. Erika Kalman



Professor Erika Kalman is currently the director of the Institute of Surface Chemistry and Catalysis in Budapest (Hungary). The main scientific area of the Institute is the design and synthesis of new nano-materials for emerging technologies including nanostructured interfaces with advanced anticorrosion and catalytic properties, membranes, nanoparticles, micro, mesoporous and layered materials.

Different surface characterization (BET, XRD, XRF, pore volume, etc.), spectroscopic techniques (infrared, Raman, NMR, EPR, UV-Vis-NIR, UPS, XPS, etc.) and microscopic techniques (STM, AFM, TEM, IRAS) are also developed.

*Last September, Prof. Erika Kalman received the European Federation of Corrosion medal award for great achievement in corrosion science and technology that is attributed once every 3 years.*

[http://www.chemres.hu/ISCC/ISCC%20Web%20Page/about\\_the\\_institute.html](http://www.chemres.hu/ISCC/ISCC%20Web%20Page/about_the_institute.html)

### Prof. Alon Hoffman

Professor Alon Hoffman is currently working as a researcher in the Chemistry Department of Technion (Israel Institute of Technology) in Haifa (Israel) but he is also consultant for the Israeli Space Program on the subject of properties of materials under upper atmosphere physico-chemical conditions. Professor Hoffman received the great Alexander Goldberg award for excellence in research on the subject "Nucleation and Growth of Diamond Films" in 2006.

His research interests are mainly the physico-chemical processes and properties of surfaces, the electron, photon, ion and thermal stimulated processes on surfaces, and the electron spectroscopy of carbon allotropes surfaces. He is also active in the field of nucleation and growth processes and mechanism of poly- and nano-crystalline diamond films, of interaction of hydrogen with single crystal, poly- and nano-crystalline diamond surfaces, and of properties of III-V semiconductor and Cu-Al surfaces.



In February 2008, he will be part of the scientific committee of the 13<sup>th</sup> Diamond Workshop which will take place in Hasselt (Belgium) (<http://www.imo.uhasselt.be/SBDD2008/>). He will also give a talk as invited speaker on his study related to hydrogen on/in polycrystalline diamond films of micron to nano grain size.

<http://www.technion.ac.il/technion/chemistry/staff/hoffman/>





## POTENTIAL ASSOCIATE MEMBERS

### IonBond

Ionbond traces its beginnings to the Swiss automotive manufacturer Berna, which was founded in 1904. Nowadays, IonBond possesses 2 headquarters in the world; one in Olten (Switzerland) and one in Madison Heights (USA - Minnesota). It is an innovative, high-quality provider of advanced coatings and coating equipment. Their aim is to build up the service and equipment business with maximum effort and commitment in the next years.



The broad product range, offered through specialized centers for coating of components, cutting, stamping and forming tools, decorative applications and medical instruments, will enable them to offer our customers all the advantages of a global player while maintaining the local contact which is so important. Today, Ionbond offers the broadest range of thin film technologies, including CVD, PACVD, PVD, TetraBond and CVA and counts nearly 400 systems in use in over 30 countries worldwide. Chemical Vapor Deposition (CVD) is used with a typical process temperature between 720°C and 1050°C to coat mainly carbides inserts, punches, metal forming tools and extrusion dies. The coatings typically deposited are TiC, TiCN, TiN and



alpha and kappa aluminium oxide ( $Al_2O_3$ ) as single or multi-layer. Plasma Assisted Chemical Vapor Deposition (PACVD) is used to deposit extremely smooth, well adhered Amorphous Diamond-Like Carbon (ADLC) coatings in a high vacuum environment at temperatures below 200°C on both conductive and insulating materials. Common applications include engine and machine components, pump parts, medical devices and decorative items. Physical Vapor Deposition (PVD) is characterized by the creation of a metal vapor that can be reacted with different gases to form a thin film coating and the typical process temperature for PVD coatings is between 250°C and 450°C. Applications include cutting and forming tools, wear components, medical devices and decorative products. The coatings typically deposited are TiN, AlTiN, TiAlN, CrN, CrCN, TiCN and ZrN. More complex coatings can include TiAlCrYN or a W-C: H / DLC combination. TetraBond technology is an enhanced arc technology based on the PVD process. The enhanced arc process was developed by Ionbond and allows the deposition of extremely hard, very smooth, non-hydrogenated DLC films (Hardness = 70-90 GPa). Chemical Vapor Aluminizing (CVA) is based on the CVD process and is used for depositing CVD aluminide coatings for high temperature applications.

IonBond website: <http://www.ionbond.com/>

IonBond Contact person: Franck Derangere

VINF contact people: Frédéric Mirabella and Marie Haidopoulo

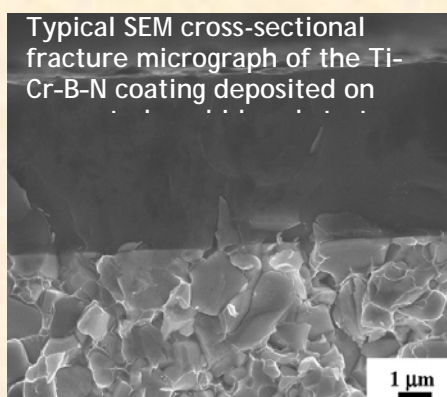


## Hard tribological Ti-Cr-B-N coatings with enhanced thermal stability, corrosion- and oxidation resistance

D.V. Shtansky, Ph.V. Kiryukhantsev-Korneev, A.N. Sheveyko, A.E. Kuttyrev, E.A. Levashov

Moscow State Institute of Steel and Alloys, Leninsky pr. 4, Moscow 119049, Russia

Surface & Coatings Technology 202 (2007) 861-865.



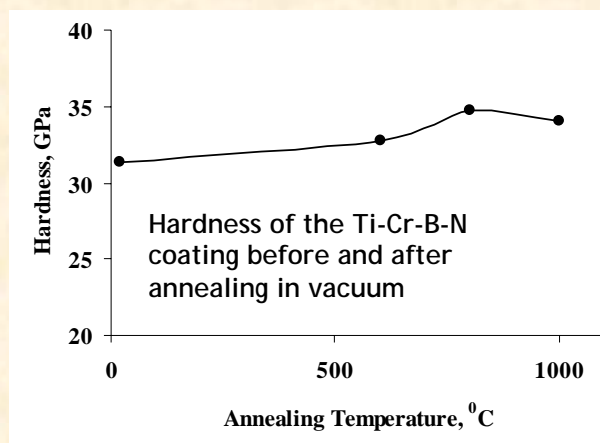
Corrosion and oxidation resistance are of great importance for hard tribological coatings when it concerns thermal stability under severe cutting conditions. A comparative investigation of Cr-doped Ti-B-N coatings deposited by DC magnetron sputtering of TiCrB targets with 20, 30 and 40 wt % of chromium in a gaseous mixture of argon and nitrogen is presented. The TiCrB composite targets were synthesized using combined force SHS-pressing technology. The structure, elemental and phase composition were studied by means of X-ray diffraction, transmission and scanning electron microscopy, as well as focused ion beam equipped with secondary ion mass spectrometer. To evaluate the thermal stability and oxidation resistance, the Ti-Cr-B-N coatings were annealed at 600, 800, and 1000°C in vacuum and at 600, 700, 800, and 900°C in air, respectively. The potentiodynamic polarization tests of the Ti-Cr-B-N coatings were carried out and compared with those for the Ti-B-N, Ti-Si-B-N, and Ti-Al-Si-B-N reference coatings.

### Summary

From the results obtained it can be concluded that the magnetron sputtering of the TiCrB composite targets under controlled deposition parameters resulted in the growth of strongly (100) textured Ti-Cr-B-N coatings with high hardness and wear resistance, superior thermal stability up to 1000°C, improved oxidation resistance up to 900°C, and enhanced corrosion resistance in 1N H<sub>2</sub>SO<sub>4</sub> solution, which are important properties for high-speed and dry cutting tool applications. High-temperature heat treatment improved the adhesion strength and fracture toughness of the Ti-Cr-B-N coatings, whereas their *fcc* structure with strong (100) texture, friction and wear characteristics retained unchanged.

With increasing chromium content the Ti-Cr-B-N coatings showed improved adhesion strength and oxidation resistance, whereas their hardness decreased.

The potentiodynamic tests of the Cr-doped Ti-B-N coatings in comparison with Ti-B-N, Ti-Si-B-N, and Ti-Al-Si-B-N reference coatings showed a more positive value of corrosion potential and a stable passive layer at low current density.



*The work has been supported in part by the FP6 Framework Program under contract number NMP3-CT-2005-515703, Project EXCELL.*





## SCIENTIFIC CONTRIBUTIONS

1. Ph.V. Kiryukhantsev-Korneev, J.F. Pierson, A.N. Sheveyko, A.E. Kutyrev, M. Alnot, J.P. Bauer, E.A. Levashov, D.V. Shtansky, Structure and properties of hard nanostructured coatings in Cr-B-N system, The 3<sup>rd</sup> French-Russian Seminar "New Achievements in Materials and Environmental Science", Metz, November 7-9, 2007, Proceedings, p. 18.
2. E.A. Levashov, E.I. Zamulaeva, V.V. Kurbatkina, D.V. Shtansky, J. Epishko, Advanced multifunctional nanostructured films and nanoparticles disperse-strengthened coatings, The 3<sup>rd</sup> French-Russian Seminar "New Achievements in Materials and Environmental Science", Metz, November 7-9, 2007, Proceedings, p. 20.
3. F.V. Kiryukhantsev-Korneev, A.N. Sheveiko, D. Sorokin, D.V. Shtansky, Multilayered and Nanocomposite TiCrBN/WSex Coatings Deposited by Ion Implantation Assisted Sputtering of TiCrB and WSe<sub>2</sub> targets, EUROMAT-2007, Nürnberg 10-13 September, 2007.
4. I.A. Bashkova, D.V. Shtansky, N.A. Gloushankova, A.N. Sheveiko, F.V. Kiryukhantsev-Korneev, E.A. Levashov, Bioactive (Ti,Ta)-Based Ceramics Coatings for Implants, EUROMAT-2007, Nürnberg 10-13 September, 2007.
5. A.N. Sheveiko, Ph.V. Kiryukhantsev-Korneev, M.I. Petrzhik, D.V. Shtansky, E.A. Levashov, O.I. Obrezkov, B.A. Vershok, Influence of high-energy metal ion implantation on the structure and properties of Ti-based ceramics coatings, EUROMAT-2007, Nürnberg 10-13 September, 2007.
6. D.V. Shtansky, Ph.V. Kiryukhantsev-Korneev, A.N. Sheveyko, A.E. Bashkova, M.I. Petrzhik, N.A. Gloushankova, I.V. Reshetov, A.S. Grigoryan, E.A. Levashov, Nanostructured films. From mechanical engineering to medicine, In Book of Reports of XVIII International Conference on Ion-Surface Interactions (ISI-2007), August 24-28, 2007, Zvenigorod, Moscow Region, Russia, Chapter 3, pp. 10-15.



## FUTURE EVENTS

### EXCELL - VINF

- International Conference on Functional Coatings, March 30- April 2, 2008 - Budapest (Hungary). <http://www.chemres.hu/nanocoatings/>
- EXCELL Global Meeting, April 2 (pm)-3, 2008 - Budapest (Hungary)
- EXCELL Annual Revue Meeting with EC, June 19-20, 2008 - Como (Italy).
- International Workshop on Recent developments in the processing and applications of structural metals and alloys, June 22-27, 2008 - Como (Italy).

Topics of the conference:

- 1- Severe plastic deformation of nanostructured structural materials
- 2- Creep and hot deformation of metallic materials
- 3- Modern joining techniques
- 4- New ferrous and non ferrous alloys for structural applications
- 5- Multifunctional nanostructured coatings

### OTHER

- I-SUP2008 international conference - Innovation for Sustainable Production, April 22-25, 2008 - Bruges (Belgium). <http://www.i-sup2008.org>

Topics of the symposium "Smart Materials for Sustainable Production":

- 1- Production and application of nanomaterials
- 2- Biomaterials for improved quality of life
- 3- Porous materials for protecting the environment
- 4- Advanced surface treatments: eliminating solvents
- 5- Controlling friction, preventing wear in industrial processing
- 6- Looking at materials at nanoscale

- 14<sup>th</sup> International Conference on Thin Films and Reactive Sputter Deposition, November 17-20, 2008 - Ghent (Belgium). <http://www.ictf14.ugent.be/>

Topics of the conference:

- 1- Fundamentals of Thin Film Growth & Epitaxy
- 2- Nanostructured Growth
- 3- Organic T.F.'s
- 4- Biosurfaces related to T.F. growth
- 5- Applications of T.F. growth
- 6- Advances in deposition techniques
- 7- Characterization and Instrumentation

