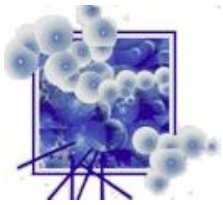
VINF
Virtual Institute of Nano Films

# VINF Newsletter n°9
## September 2009



### *Editorial*

*As expected, VINF summer has been full of news and great changes. Always targeting its self-sustainability and its goal of overcoming the fragmentation in European Nanofilm research, the Institute is working on many projects and events. The fourth module of our European Post-graduate Program on Nanofilms will take place in Russia in October. Its topic is mechanical applications and optical characterization of Nanofilms and should be of great interest to the participants. The Institute is also organising a local workshop in Belgium to create a community on Nanofilms. Hopefully, this event will lead to other local workshops in many European countries. On a more practical matter, VINF has moved its headquarters to a new office in the Science Park in Liège. We are enjoying our new place in a very quiet and woody area. We have also welcomed a new member: CSM, from Italy. Last but not least, VINF has hired a new General Manager who joined VINF at the beginning of September. His presence will be a great asset for the Institute and we wish him great success in his new position. The ECNF conference is fast approaching, and even though the deadline for submitting an abstract is at the end of September, it is not too late to submit yours. It is also time to register if you want to benefit from early-bird fees. We hope that you enjoyed your summer time and that you are up and ready for this colourful season.*

***The VINF Management Team***

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# Highlights: VINF New Member, CSM

This summer, CSM officially joined VINF. We are delighted to welcome CSM in our team of experts.

Centro Sviluppo Materiali S.p.A.

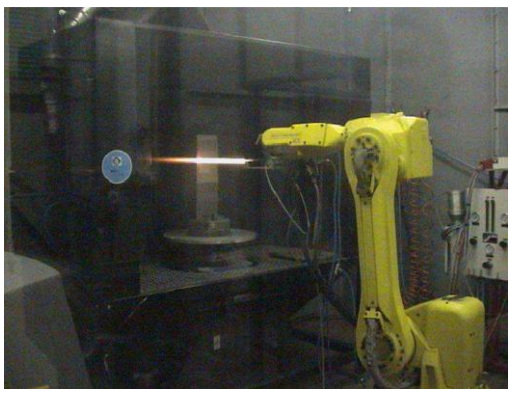
## Presentation

CSM is working with nanostructured surfaces mainly in the fields of Aerospace and Defense. The aim of their main projects is the development of complete systems process/product, up to the studies of the industrialisation, the technical/cost analyses, the prototyping phase and, for small amounts (hundreds pieces per year), the pre-industrial productions.
For high temperature applications, CSM has patented a new class of ceramic coatings, in the frame of the UHTC (Ultra High Temperature Ceramic); above 1300 °C they are able to passive their surface with a self-repairing, oxidation protective scale.
Relating the protection of light alloys and mild steels, a new generation of coatings has been developed, combing different deposition technologies (i.e. thermal spraying and PVD), to produce graded and functional layers, maintaining a poor substrate. The control of the surface nanostructure has been the key to produce surfaces with tailored optical and electromagnetic properties.

## For more information:

Web site: http://www.c-s-m.it
Address: Centro Sviluppo Materiali S.p.A. Rome Headquarter
Via di Castel Romano, 100
00128, Rome ITALY
Ph. +39.06.5055253
Fax +39.06.5055202

Thermal Spraying Facilities:
JP- 5000 Plant



# VINF Research Projects

VINF scans regularly European, National and Regional research calls. We can help by:

- Watching and surveying the calls;
- Selecting and spreading information towards the network;
- Identifying and finding partners;
- Preparing proposals for the submission of the project.

The Institute can be coordinator or core partner within the research or dissemination activities. If you think you might be interested in collaborating with us, please don't hesitate to contact us.

# VINF European Post-graduate Training on Nanofilms


Program funded by the European Commission
(FP6 Program)

## Description

Harvesting its expertise in the domain, the EXCELL/VINF consortium launched a training program with advanced lectures and seminars related to Nanofilm Science and Technology. The fundamental objective of the program is to provide education on available methodologies in the field of nanostructured thin films and coatings: preparation; characterisation; mechanical, optical and biomedical applications, and the fundamental aspects in clusters and nano-objects. The program is based on 5 modules covering the main aspect of the synthesis, characterization, and some selected applications of the Nano-films.

## Module IV and II (part 2)

The Module IV and the second part of the Module II "Mechanical applications and optical characterization of Nanofilms" will be co-organized by National University of Science and Technology "MISIS" and Institute of Spectroscopy of Russian Academy of Sciences from October 19 to October 23, 2009, in Moscow and Troitsk (Russia). The topic of this module is: *Mechanical applications and optical characterization of Nanofilms*.

There will be 24 young scientists attending this module.

## Program of Module IV

Each theoretical presentation will last 1 hour (including questions and comments), and each practical session will last 1.5 hour.

| Mechanical Applications | |
|---|---|
| **LECTURES** | |
| **Multicomponent Nanostructured Coatings. Fundamental Principals, Deposition, Characterization and Testing** | Prof. D. Shtansky (State Technological University - Moscow Institute of Steel and Alloys) |
| **Disperse- Strengthened by Nanoparticles Tribological Coatings** | Prof. E. Levashov (State Technological University - Moscow Institute of Steel and Alloys) |
| **Different approaches to the design of superhard materials and their non-linear mechanical properties and problems during the measurement of their hardness and elastic modulus** | Prof. S. Veprek (Technische Universitaet Muenchen) |
| **Tribology of carbon-based lubricant coatings** | Dr. J.C. Sanchez-Lopez (Instituto de Ciencia de Materiales de Sevilla) |
| **Imaging, image modification, image analysis in (nano-) materials science** | Dr. P. Nagy (CRC HAS Chemical Research Center of the Hungarian Academy of Sciences) |
| **Formability of coated steels** | Prof. S. Spigarelli (Università Politecnica delle Marche) |
| **Mechanical behaviour of nanofilms and coatings** | Prof. E. Gutmanas (Technion) |
| **Characterization of Solid Thin Films and Functional Surfaces of Advanced Materials by Mechanical Contact Testing** | Dr. M. Petrzhik (State Technological University - Moscow Institute of Steel and Alloys) |
| **Methods of contact and non-contact characterization of surface topography** | Dr. Yu. Pogozhev (State Technological University - Moscow Institute of Steel and Alloys) |
| **Friction and wear of coated surfaces – from theory to practice** | Dr. Irina Bashkova (State Technological University - Moscow Institute of Steel and Alloys) |
| **PRACTICAL TRAINING** | |
| **Nanoindentation** | Dr. M. Petrzhik (State Technological University - Moscow Institute of Steel and Alloys) |
| **Scratch Testing** | Dr. M. Petrzhik (State Technological University - Moscow Institute of Steel and Alloys) |
| **Surface Topography** | Drs. M. Petrzhik, Yu. Pogozhev (State Technological University - Moscow Institute of Steel and Alloys) |
| **Friction and Wear** | Drs. M. Petrzhik, I. Bashkova (State Technological University - Moscow Institute of Steel and Alloys) |

| Optical Characterization | |
|---|---|
| **LECTURES** | |
| **IR spectroscopy of dielectric thin films on metal substrate.** | Prof. E.A.Vinogradov (Institute of Spectroscopy of Russian Academy of Sciences) |
| **Surface polariton spectroscopy** | Prof. V.A.Yakovlev (Institute of Spectroscopy of Russian Academy of Sciences) |
| **Raman spectroscopy of condensed matter** | Prof. B.N. Mavrin (Institute of Spectroscopy of Russian Academy of Sciences) |
| **Experimental methods of Raman spectroscopy** | Dr. V.N. Denisov (Institute of Spectroscopy of Russian Academy of Sciences) |
| **Atom nanolithography based on method of atom optics** | Prof. V.I. Balykin (Institute of Spectroscopy of Russian Academy of Sciences) |
| **Single molecules as a spectral nanoprobe for characterization of processes in condensed matter** | Dr. A.V. Naumov (Institute of Spectroscopy of Russian Academy of Sciences) |
| **PRACTICAL TRAINING** | |
| **Raman study** | Dr. V.N. Denisov (Institute of Spectroscopy of Russian Academy of Sciences) |
| **Fourier-Raman study** | Prof. B.N. Mavrin, (Institute of Spectroscopy of Russian Academy of Sciences) |
| **IR Fourier study** | Dr. N.N.Novikova, Prof. V.A.Yakovlev (Institute of Spectroscopy of Russian Academy of Sciences) |

## *VINF Initiative* Workshop

*VINF Initiative I: Building up the Belgian Community on Nano Films*, is the first edition of a series of workshops to be organised throughout Europe to build national networks of key players in nanofilms. Doing so, the Institute intends to facilitate communication and motivate the collaboration among players with common interest. With these workshops, VINF fulfils two of its most strategic goals: the integration of people (with memberships and networking) and the participation in research projects, since those events are very important to help find potential partners with innovative ideas for new projects.

# European Conference on Nanofilms (ECNF)

The first European Conference on Nanofilms (ECNF) is in less than six months. The event will take place from March 22nd to March 25th, 2010. This means there are only 173 days left before the opening of the conference. Don't forget to register if you want to benefit from the available early-bird fees.

If you haven't sent your abstract yet, now is the time to do so. The submission of abstract will still be accepted until the end of October.

If you want to become a sponsor of the conference, you can go online and check our sponsorship manual: http://www.vinf.eu/ecnf/sponsoring.html. Shall you have any questions, please feel free contact Alain Gallez for more information: alain.gallez@eventis.com

**Invited Speakers: Prof. Dr. Michael Veith and Dr. Gerhard Schottner**

Prof. Dr. Michael Veith will be our keynote speaker for the session: *From nanoparticles to nanofilms: manufacturing methods & processes*. He is a chemist. In addition to being the scientific director of the Leibniz Institute for New Materials (INM) in Saarbrücken, he has been holding the Chair of General and Inorganic Chemistry at Saarland University since 1984. He is a member of many national and international bodies and has given several guest lectures in the US and France.

Dr. Gerhard Schottner will be our keynote speaker for the session: *From Science to Society: mass production & integration of nanofilms*. He is head of the department "Surface and Coating" at the Fraunhofer Institute of Silicate Research, Germany. He is a specialist of the sol-gel process. Among other projects, he is working on colour coatings on glass (ORMOCER®), and he was involved in the successful project NANO EFFECTS, Nanocomposites with High Colouration Efficiency for Electrochromic Smart Plastic Devices (FP6).

For more info, visit
the conference website

http://www.ecnf.eu

ecnf

2010 EUROPEAN CONFERENCE ON NANO FILMS

Contact the ECNF
management team

info@ecnf.eu

**Important Dates**

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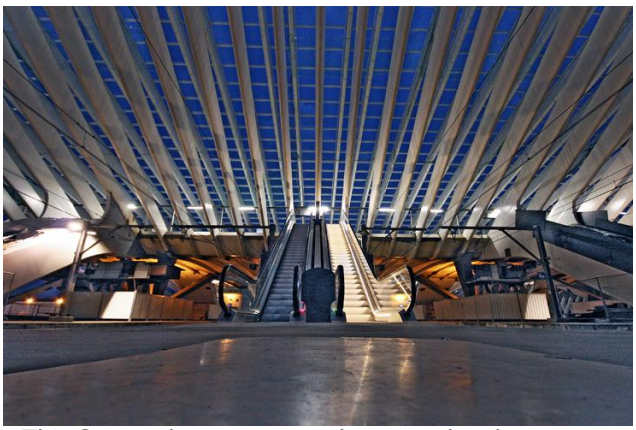
|---|---|
| Currently opened | Early bird registration |
| October 31st, 2009 | Deadline for abstract submission |
| November 15th, 2009 | Notification to authors<br>Call for full papers |
| December 31st, 2009 | Deadline for full papers<br>End of early bird registration |

*Liège, borders of the Meuse river*



*This September, a new rail station has been opened in Liège. After 9 years of work, and 312 millions of euros, the grand opening was the occasion of a great show and huge fireworks. This new station should welcome many of the ECNF participants. This station is the work of the Spanish architect: Santiago Calatrava.*

## VINF New General Manager: Damien Lourtie

At the beginning of September, Ing. Damien Lourtie joined VINF as its new General Manager. He graduated from the University of Liège as electromechanical engineer in 2003 and completed his education with a master in industrial management in 2004 (from University of Liège and Maastricht).

These complementary skills gave him the opportunity to work as project manager at Techspace Aero (Safran Group), a large airplane engine manufacturer. During these five last years, He set up and managed different European projects (FP6) and national research programs on composite material and other mechanical topics. These projects had a budget of several million euros and consortium with more than ten partners.

## VINF New Headquarters


It's official, we have moved the VINF headquarter to a new office located in Liège Science Park. We are working in a quiet and very productive environment, only five minutes from the city and from ArcelorMittal Research Centre.

Our new address: Virtual Institute of Nano Films
Allée des Noisetiers, 2/30
4031 Angleur, Belgium

Our new phone number: +32 (0)4 367 83 25

## *In Memoriam*: Erika Kalman

Erika Kalman passed away last August. She was an EXCELL participant, and the retired director of the Institute of Nanochemistry and Catalysis (Chemical Research Center, the Hungarian Academy of Sciences).

The entire VINF team expresses its sadness towards her family, her friends and colleagues.

## VINF Presence at the AIV Conference

The 19th AIV (Italian Vacuum Association) conference –a three-day convention with speakers coming from major scientific institutions, universities, international research institutes and companies– was held in Senigallia (Marche, Italy), from May 19th to May 21st.

Based on the expertise of the AIV in the fields of advanced materials, plasma processing, micro and nanotechnologies, the conference program focused on some strategic themes revolving around the common topic of energetic. The conference addressed the most current scientific and technological trends in materials, inorganic and organic nanostructures as well as hybrid and biological nanostructures.

Ph.D. students Adele Di Salvia and Paola Ricci, from Polytechnic University of Ancona, presented a poster during the poster session. They showed the activity and expertise of Mechanical Engineering Department of Marche Polytechnic University (Ancona, Italy) on coatings characterisation. VINF was also promoted, especially regarding its role in helping industrialists, academics, and research sponsors to work more effectively together and to reduce the fragmentation in the field of nanostructured coatings.

# Atom Pinhole Camera: A New Tool for Parallel Nanometer Patterning on a Surface

**P.N. Melentiev, D.A. Lapshin, V.I. Balykin**
Institute of Spectroscopy,
Troitsk, Moscow reg., Russia

**A.V. Zablozkiy, A.A. Kuzin, A.S. Baturin**
Moscow Institute of Physics and Technology,
Dolgoprudniy, Moscow reg., Russia

## Abstract

An optical pinhole camera is a lens-free camera. A small aperture plays a role of a lens. We have experimentally realized an atom pinhole camera and have built with it an array of identical arbitrary-shape atomic nanostructures on a Si and glass surfaces with the minimum size of an individual nanostructure's element down to 50 nm. The theoretical prediction of atom pinhole camera resolution is of the order of 6 nm. This new and very promising surface patterning technique may find application in development of elements for nanoelectronics, plasmonics, spintronics, bio-nano-sensors and metamaterials.

# Comparative investigation of TiAlC(N), TiCrAlC(N), and CrAlC(N) coatings deposited by sputtering of MAX-phase Ti2 − xCrxAlC targets

**D.V. Shtansky[a], , Ph.V. Kiryukhantsev-Korneev[a], A.N. Sheveyko[a], B.N. Mavrin[b], C. Rojas[c], A. Fernandez[c] and E.A. Levashov[a]**

[b] Institute of Spectroscopy of RAS, Troitsk, Russia

[a] State Technological University "Moscow Institute of Steel and Alloys", Moscow, Russia

[c] Instituto de Ciencia de Materiales de Sevilla, Centro Mixto CSIC-Universidad de Sevilla, Sevilla, Spain

## Abstract

A comparative investigation of the structure and properties of TiAlC(N), TiCrAlC(N), and CrAlC(N) coatings deposited by sputtering of MAX-phase Ti2 − xCrxAlC targets (where x = 0, 0.5, 1.5, and 2) in an Ar atmosphere or in a gaseous mixture of Ar + N2 is presented. The coatings were characterized in terms of their structure, elemental and phase composition, hardness, elastic modulus, elastic recovery, thermal stability, friction coefficient, wear rate, corrosion, and high-temperature oxidation resistance. The structure of the coatings was studied by means of X-ray diffraction, scanning and transmission electron microscopy, X-ray photoelectron spectroscopy, glow discharge optical emission spectroscopy, electron energy loss spectroscopy, and Raman spectroscopy. To evaluate the thermal stability and oxidation resistance, the coatings were annealed either in vacuum or in air at temperatures 600–1200 °C. The results obtained show that the TiAlCN coatings possess high hardness of 32–35 GPa, low friction coefficient against WC–Co well below 0.25, high thermal stability up to 1200 °C, and superior performance in dry milling tests against high Cr steel. Meanwhile, the coatings with high Cr content demonstrated improved oxidation resistance up to 1000 °C and superior electrochemical behavior, but their mechanical and tribological properties were deteriorated.

*This paper was supported partly by EXCELL funding and 3 teams have been involved.*

## VINF Forthcoming Events

**October 7th, 2009** — **VINF Initiative I: Building up the Belgian Community on Nano Films**
This first edition will be held in Liège, Belgium

**October 19th-23rd, 2009** — **European post-graduate training on Nanofilms** / Modules II (Part II – Optical characterization of Nanofilms) & IV (Mechanical applications of Nanofilms) in Moscow and Troitsk, Russia

**March 22nd-26th, 2010** — **European Conference on Nano Films (ECNF)** in Liège, Belgium

## Other Forthcoming Events

**ITFPC 09**
**Innovations in Thin Film Processing and Characterisation**

*November 17-20, 2009 - Nancy (France)*
http://www.vide.org/itfpc09/

The fourth international conference on **Innovations in Thin Film Processing and Characterisation ITFPC 09** is organised jointly by the French Vacuum Society (SFV) and the Institute Jean Lamour from Nancy University and University Paul Verlaine of Metz.

Over the past years, the continuously growing interest in thin film growth, processing and applications has provoked strong academic and industrial activity resulting in great progress in research, development and functionalisation of surfaces. Thus, this area appears to underlie great potential applications in te fields of microelectronics, nanotechnology, mechanics, optics, photonics, chemistry, biology and medicine.

Besides the scientific topics covered by the conference, ITFPC'09 aims at providing an open forum to discuss the progress and latest developments in thin film processing and engineering including nano-layer growth and properties, surface functionalisation, etching, CVD and PVD processes.

## Development and Commercialization of Advanced Nanostructured Materials and Coatings

*October 22nd, 2009 – Moscow (Russia)*

This international workshop is organised for the celebration of the 20th Anniversary of the Scientific-Educational Centre of Self-Propagating High Temperature Synthesis in Russia. Prof Gutmanas and Prof. Veprek will honoured the workshop with invited lectures:

E. Gutmanas, I. Gotman "Dense in situ Ceramic Matrix Composites via Pressure Assisted Thermal Explosion Mode of SHS: From Basic Research to Fabrication of Structural Parts"

Stan Veprek "Search for Ultrahard Materials and Recent Progress in the Understanding of Hardness Enhancement and Properties of Nanocomposites"

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## NANOTECH BUSINESS Summit

*December 4-7, 2009 – Cairo (Egypt)*
http://www.nanobus.sabrycorp.com/conf/nanobus/09/index.cfm

The **Nanotech Business Summit** is the first forum of its kind to facilitate the integration of nanotech products into the global economy by connecting middle eastern capital with small tech innovations. The booming middleeast has begun to wake up to the manifold opportunities that nanotech presents and has started to move rapidly into nanoscience. Billions of dollars have already been allocated for nanoscience research and are available for investment. This conference brings together senior business leaders and world-renowned innovators to explore the ways that nanotechnology will become the next big growth innovation. The summit provides informative presentations, business match-making services and numerous networking opportunities to serve as an incubator of new ideas and new relationships. An introductory lecture on business opportunities for nanotechnology in the middle east will be provided in addition to lectures on the topics listed below, which will include (but not be limited to) aspects of nanotechnology: commercialization, business development, Intellectual Property, venture capital, emerging markets, public policy, legal, current realities and future prospects.

Amongst the 12 scheduled topics, some few of them will be relevant within the VINF business Energy (Fuel Cells & Batteries, Oil Extraction, Solar, Catalysts, Biomimetics), Communications (MEMS, NEMS, Active Devices, RF Devices, Nano-Robotics, Applications for Nano-Networks), Textiles (Smart polymer materials, smart colloids, thin films), Environment (Protection, Remediation, Solutions for Air, Water, Waste, Regulations), Food (Colloids, Surfaces and Films, Soft Nanotech), Polymers (Polymer Nanotech, Additives & Particulates, Composites & Interfaces), Coatings (Thin Films, Electronics, Smart Coatings, Optical Coatings), Semiconductors (Molecular Electronics, Nano-Photonics, Memory).