Forum on Europe-USA Collaboration in Materials Research

European Materials Research Society (E-MRS)
2005 Spring Meeting
OBERLIN Room

Strasbourg, France
May 31, 2005

Updated: May 11, 2005

Forum on Europe-USA Collaboration in Materials Research
E-MRS 2005 Spring Meeting
May 31, 2005

Dear Colleagues,

We are pleased to welcome you to the Forum on Europe-USA Collaboration in Materials Research. All US-European research groups funded under NSF-Europe cooperative activity in materials research have been invited to join this event. The purpose of this event is to:

- Enable US and European colleagues to meet face-to-face to report research findings, raise technical issues, and discuss future plans
- Improve networking and cooperation among grantee groups
- Inform the international materials community of collaborative research being performed under the joint program.

We would like to thank the leadership of the European Materials Research Society and their excellent staff for providing the space and facilities for this event. We would also like to thank the following funding agencies for supporting our collaborative partnerships under this joint program:

- Austrian Science Fund (FWF)
- National Fund for Scientific Research (F.N.R.S.)/French Community, Belgium
- Fund for Scientific Research-Flanders, Belgium
- Grant Agency of the Czech Republic (GACR)
- European Commission (EC)
- European Science Foundation
- Tekes, the National Technology Agency of Finland
- Academy of Finland Research Council for Natural Sciences & Engineering
- Centre National de la Recherche Scientifique (CNRS) France
- Deutsche Forschungsgemeinschaft and other German organizations
- Ministry of Development, Greece
- Hungarian Academy of Sciences
- National Office for Research and Technology, Hungary
- Enterprise Ireland
- Science Foundation Ireland
- Consiglio Nazionale delle Ricerche (CNR) Italy
- Consorzio Interuniversitario Nazionale per la Scienza e Tecnologia dei Materiali (INSTM) Italy
- National Institute for the Physics of Matter (INFM) and other Italian organizations
- Fonds National de la Recherche, Luxembourg
- Foundation for Fundamental Research on Matter (FOM), The Netherlands
- The Research Council of Norway, Science and Technology Division
- KBN (State Committee for Scientific Research), Poland
- Science and Technology Foundation (FCT), Portugal
- Ministry of Science and Technology, Spain
- Swedish Foundation for Strategic Research (SSF)
- Swiss National Science Foundation
- Engineering & Physical Sciences Research Council (EPSRC), United Kingdom
- National Science Foundation (NSF) United States

Finally, we would like to thank all of the researchers and program managers who have joined us here in Strasbourg. We look forward to hearing your experience, best practices, and suggestions for improving and expanding Europe–USA collaborations in materials research.

Sincerely,

R.P.H. Chang
Materials Research Institute (USA)

Gabriel Crean
Tyndall National Institute (Ireland)

Updated: May 11, 2005

Forum on Europe-USA Collaboration in Materials Research
E-MRS 2005 Spring Meeting
May 31, 2005

Tuesday, May 31 (OBERLIN Room – 1st floor)

8:30 - 9:00 **Opening Remarks by Organizers and E-MRS President**

9:00 – 9:30 **Invited Talk 1: Design and Characterization of Multiphoton Materials,** Hans Agren, Royal Institute of Technology, Stockholm (Sweden)

9:30 – 10:30 **Panel: Government Agencies**
Session Chair: Andy Rendell, Engineering & Physical Sciences Research Council (EPSRC) **Panel Members:** Petri Ahonen, Academy of Finland; Sisko Sipila, Tekes-Finland; Burkhard Jahnen, DFG-Germany; Joseph Gyulai, Academy of Sciences-Hungary; Ignacio Fragala, INSTM-Italy; Elisa Molinari, INFM-Italy; Christiane Kaell, FNR-Luxembourg; Rosa Menendez, MCyT-Spain; Anders Sjolund, SSF-Sweden; Lance Haworth, NSF-USA; Carmen Huber, NSF-USA

10:30 – 11:00 **Break**

11:00 – 11:30 **Invited Talk 2: Vortex Pinning by Symmetric Arrays of Magnetic Nanostructures,** Ivan K. Schuller, University of California San Diego (USA)

11:30 – 12:00 **Invited Talk 3: Materials and Devices for Spin Manipulation,** Josep Fontcuberta, Instituto de Ciencia de Materiales de Barcelona (Spain)

12:00 – 12:30 **Invited Talk 4: Organic and Molecular Electronics-Some Issues and Some Aspects,** Mark Ratner, Northwestern University (USA)

12:30 – 14:00 **Lunch**

14:00 – 15:30 **Topical Panel 1: Research Needs / Shared Facilities**

Session Chair: Stefan Müller, Erlangen (Germany) **Panel Members:** Clivia Sotomayor Torres (Ireland); L. Pentti Karjalainen (Finland); Imre Kiricsi (Hungary); Brian Wirth (US); Ibrahim Karaman (USA); Susan Sinnott (USA)

15:30 – 16:00 **Break**

16:00 – 18:00 **Topical Panel 2: Student and Faculty Exchanges**

Session Chair: Bruno de Cooman, University of Ghent (Belgium) **Panel Members:** David Duday (Luxembourg); John Abelson (USA), Ellen Ivers-Tiffee (Germany); Thierry Cardinal (France); Enrico Evangelista (Italy); Eva Malmstrom (Sweden); Karen Wooley (USA)

18:00 – 18:15 **Closing remarks by Organizers**

Forum on Europe-USA Collaboration in Materials Research
E-MRS 2005 Spring Meeting
May 31, 2005

ABSTRACTS

Invited Talk 1: Design and Characterization of Multiphoton Materials

Hans Ågren, Theoretical Chemistry, Royal Institute of Technology, Stockholm, Sweden

In this talk I highlight ongoing research within a project on multiphoton materials carried out in collaboration between the Institute of Lasers, Photonics, and Biophotonics, SUNY at Buffalo, USA and the Center of Advanced Molecular Materials in Sweden. The project is rooted in that novel compounds featuring large multiphoton absorption cross sections are of particular interest due to many attractive applications exploiting high order non-linearity of media's response to exciting light. These include, for example, ultrahigh-resolution biological imaging (multiphoton confocal microscopy), high-efficiency upconverted lasing for infra-red to visible upconversion, and optical power limiting, where the range of radiation amenable to effective suppression can be extended to the infra-red region. The collaboration involves design by theoretical modeling, synthesis and characterization. The research has mostly addressed organic and organometallic compounds, but has recently also been extended to the design of multiphoton quantum dots. These offer the combined advantage of brilliance and photo-resistance of normal quantum dots with the 3-dimensional confocality and penetration of multiphoton excitation, something that can have a broad ramification on fluorescence based experiments in biology. The project is jointly funded by NSF and SSF (the Swedish Foundation for Strategic Research).

Invited Talk 2: Vortex Pinning by Symmetric Arrays of Magnetic Nanostructures

Ivan K. Schuller, Physics Department, University of California-San Diego

Defects in superconducting materials lead to a large variety of static and dynamic vortex phases. In particular, the interaction of a vortex lattice with regular arrays of pinning centers, such as holes or magnetic dots, gives rise to commensurability effects. These commensurability effects are observed in the magnetoresistance and critical current dependence with the applied magnetic field. For a number of years it was shown that the periodic pinning depends on the properties of the vortex lattice and also on the dots characteristics. However, neither the main pinning mechanisms by the magnetic dots nor the dependence on the geometry of the pinning arrays are well understood.

To clarify the pinning mechanisms, we studied and compared periodic pinning effects in Nb films with rectangular dot arrays of Ni, Co, Fe and Ni covered with thin Ag layers of varying thicknesses, as well as the pinning effects in a Nb film deposited on a patterned substrate without any magnetic material. I will discuss the differences of pinning phenomena arising from magnetic and structural effects.

To clarify the effects of the pinning geometry we studied the vortex-lattice dynamics in Nb films with rectangular arrays of Ni dots. We performed magnetotransport experiments in which two in-plane orthogonal electrical currents are injected at the same time. This allows selecting the direction and intensity of the resultant driving current on the vortex motion. The

background dissipation is angular dependent at low magnetic fields. Increasing the applied magnetic field smears out this angular dependence. The periodic pinning potential locks in the vortex motion along channeling directions. Because of this, the vortex-lattice motion maybe up to 85^0 off the driving force direction. This work was supported by NSF and Spanish Ministerio Educacion y Ciencia.

Invited Talk 3: Materials and Devices for Spin Manipulation
Josep Fontcuberta, Institut de Ciència de Materials de Barcelona, Consejo Superior de Investigaciones Científica (Spain)

Spintronics require the manipulation of spin polarized charge currents. Progress in this direction requires getting materials with a large spin polarization -that is materials in which there is a large unbalance between spin-up and spin-down population of charge carriers- and the design of devices to manipulate the resulting spin-polarized current flow. In this presentation I shall overview some recent achievements on: (1) development of new materials having a full spin polarization and, (2) the design, fabrication and testing of new devices for spin manipulation.

I will show that nowadays, ferromagnetic and metallic oxides, such as Sr_2FeMoO_6, display excellent properties –full spin polarization- at low temperature and detailed understating of the origin of ferromagnetism in this system has allowed pushing their Curie temperature well above room temperature. However, severe limitations for operation still exist. Therefore it turns out, that it would be appropriate the design of devices able to spin-filter a current flow, thus leading to a nanoengineered spin-polarized source. I will collect some recent results obtained within the joint collaboration of several European partners, financed either by European governments, by U. E or by the ESF, and signal prospects for developments and future collaborations.

Invited Talk 4: Organic and Molecular Electronics-Some Issues and Some Aspects
Mark Ratner, Department of Chemistry, Northwestern University (USA)

Utilizing molecules for electronics and circuit applications raises fundamental scientific challenges, as well as engineering problems. Many major steps forward in these areas have been taken by the collaborative route - collaborations across disciplines, across national boundaries, and across physical systems. We will discuss some of the ongoing challenges in organic and molecular electronics, and some approaches being taken to address them.