

On the **COVER**

Title: Joan's Paisley

Created by: Ting Xu

Place: Materials Research Science and Engineering Center on Polymers
University of Massachusetts Amherst

Description: When an electric field is placed across a thin polymer film on a conducting surface—such as gold, aluminum or in this case, silicon, small waves on the surface of the film are amplified and grow into columns. Here, in this optical micrograph, the formation of the columns was captured when the columns began to merge together. This occurs since the system is trying to reduce the amount of surface. If you look carefully at the image, there is a characteristic periodicity in the features that have formed, which tells you about the properties of the polymer. The different areas in the film result from slight changes in the film thickness across the film. Each of the features in this image is about the size of a human hair.

This image was included in "VISUAL: Ventures in Science Using Art Laboratory," shown at the National Science Foundation headquarters in Virginia, April 2006 through June 2007, as part of The Art of Science project.

DIPC 06/7

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Source

Welcome Message from the Foundation



Donostia International Physics Center (DIPC) Foundation was created in 1999, as a fruit of foresighted collaborations between the Departments of Education and Industry of the Basque Government, the University of the Basque Country, the Provincial Authority of Gipuzkoa, the Town Hall of San Sebastian and the savings bank, Kutxa of San Sebastian and Gipuzkoa. Over last years other institutions and private companies have been incorporated to the board of patrons of the

DIPC, in particular: Naturgas Energía Grupo, S.A., Telefónica, Construcciones y Auxiliar de Ferrocarriles, S.A. (CAF) and Mapfre.

DIPC started as an intellectual center with the principal aim of promoting and facilitating the development of basic and oriented research in materials science to the highest level. DIPC has therefore been open and associated to the University of the Basque Country. Since its inception, DIPC has served as an internationalization platform for basic science in the Basque Country in the field of materials science.

In order to meet our goals, in the first consolidation stage, three basic programs were established: 1. Visiting Researchers Program, 2. International Workshops Program, 3. General Science Communication Program.

The aim of the Visiting Researchers Program was to attract the best scientists in the field of materials science. Thus, an interaction platform between researchers of high recognition from other countries and our researchers was established. From this platform, the emergence of new joint project proposals would not only be favored but the creation of an international network which allows for a better understanding and diffusion of our own scientific activity.

Pedro Miguel Echenique Landiribar
President

The International Workshops Program was intended to create new forums for debate in which experts from different arenas, yet common goals, would contribute to the resolution of hot topics. Rather than adopting the conventional format of a conference, informal meeting with a reduced number of invited scientists was preferred in order to provide plenty of free time for discussions.

Finally, the General Science Communication Program was intended to bring the world of science to the public. The social implication of this program is evident at a time when science and technology play a crucial role for the future of our world.

We will strengthen our future scientific capabilities by building synergies and partnerships with other centers of our environment.



After eight years, we can say that the objectives we set from the start have been accomplished. In this period, DIPC has become a center of reference in basic research of Materials Physics. The relevance is supported by the quality of the researchers who have visited the center, the international level of the workshops held and most of all, the importance of the scientific contributions derived from the research activity. During the period of the time of this report, 2006/07, 259 original papers have been published in journals such as, *Science* (1), *Nature* (2), *Physical Review Letters* (22), *Physical Review* (67),

Macromolecules (12), among others. It is worthy of remark that in representative journals of DIPC activity (Materials Physics and Condensed Matter) as for instance, *Physical Review B* (PRB) and *Macromolecules*, the publications from DIPC in 2006/07 mean 8.6 % (PRB) and 20 % (*Macromolecules*) of the total contribution by the Spanish institutions. Even in the case of the *Physical Review Letters*, which covers all areas of Physics, the contribution from DIPC in 2006/07 is of about 5 % of the total Spanish contribution. This is quite an achievement for such a young institution.

It is also important to note the launching in 2000 of the Fellows Guipuzkoa. This program, under the financial support of the Provincial Authority of Guipuzkoa, allows young scientists, mostly from the Basque Country, who have been working abroad, to return. DIPC acts as a “landing platform” by means of a five-year contract.

Juan Colmenero de León
General Director



Along the same line of development, we can include the creation of our in-house Computation Center. The first phase of this center was inaugurated in July 2003 with the aim of becoming an international reference in complex computational physics and materials simulation. After the enlargement of the computing building carried out over 2007, thanks to a special budget from the Spanish Ministry of Education and Science, and the recent acquisition of new powerful computing clusters, our Computational Center is approaching its equilibrium stage of operation. We hope that the center will become one of the basic pillars for future developments of scientific activity at DIPC through continuous updates in hardware.

In addition to DIPC's scientific level, it is also gaining recognition internationally as an innovative center in its structure and organization, as has been recently shown by the interest in our model of operation by other universities and research centers .

Spurred by these remarkable results, over last two years we have faced the challenge of creating a critical mass of staff researchers. The idea was not to repeat the schemes of other centers, with permanent staff positions, but of habilitating medium term contract staff (one to three years) in numbers which would allow for the proper exploitation of existing know-how and resources. In order to reach this objective, we have developed a postdoctoral and PhD contract grant program. These programs, along with the established Fellows Guipuzkoa, and the external grant systems, have enabled for the attainment of a critical mass of researchers based at DIPC. Accordingly, new spaces have been made available by the refurbishing the fourth building on the DIPC premises, which is fully operational since November 2007.

Moreover, we will strengthen our future scientific capabilities by building synergies and partnerships with other centers and institutions of our environment. In particular with the Materials Physics Department of the University of the Basque Country, the Materials Physics Center (joint institute of the University of the Basque Country (UPV/EHU and the Spanish Research Council (CSIC)) and the recently created CIC-Nanogune network. We believe this is the route to maintain our ranking on the European and international scene.

Last not least, we plan to continue publicizing the latest scientific developments and giving young people a taste for science in the framework of our General Science Communication Program.

Alberto López Basaguren
Secretary

Culture



Our PATRONS 06/7

Basque Government

José Antonio Campos Granados
Minister of Education, Universities and Research

Ana Aguirre Zurutuza
Minister of Industry, Commerce and Tourism

Jon Barrutia Guenaga (2006)
Ibone Amezaga (2007)
Vice Minister of Universities and Research

José Ignacio Tellechea Fernández
Vice Minister of Competitivity

Alfredo Zalaya Pérez (2006)
Alberto Ansuategi Cobo (2007)
Director of Science Policy

Joseba Jaureguizar Bilbao
Director of Technology and Innovation

University of the Basque Country

Juan Ignacio Pérez Iglesias
Rector

Miguel Angel Gutiérrez Ortiz
Vice Rector of Research

Provincial Government of Gipuzkoa

Joxe Joan González de Txabarri Miranda (2006)
Markel Olano Arrese (2007)
President

Joaquín Villa Martínez
Statutory Deputy, Innovation and the Society of Knowledge (2006)
Adviser to Statutory Deputy, Innovation and the Society of Knowledge (2007)

José Ramón Guridi Urrejola
General Representative, Promotion of Innovation and Knowledge (2006)
Statutory Deputy, Innovation and the Society of Knowledge (2007)

San Sebastian Town Hall

Odón Elorza González
Mayor

Kutxa

Félix Ares de Blas
General Director, Miramon.KutxaEspacio de la Ciencia (2006)
Director of Education System Relations (2007)

Naturgas Energía Grupo S.A.

Manuel Menéndez Menéndez
President

Fundación Telefónica (2006)
Telefónica S.A. (2007)

César Alierta
President

Construcciones y Auxiliar de Ferrocarriles S.A. (CAF)

Andrés Arizkorreta García
General Director

Mapfre S.A. (2007)
Filomeno Mira Candel
Vice President





Action

Research Activity

Condensed Matter Physics

Research at the Condensed Matter Physics group is currently focused into the structural, electronic and optical properties of solids, surfaces and low-dimensional systems. Particular attention is paid to systems of nanometer size. Together with the theoretical activity, in which most of the research is focused, experimental work based on scanning tunnelling microscopy (STM) and photoemission techniques is developed in the nanophysics laboratory. In general, the groups concentrate on the following areas of research:

- Structural and electronic properties of materials using first-principles methodologies. Among other systems, bulk materials, surfaces, metal clusters, molecules of biological interest, and nanowires, have been recent targets of study.
- Electron dynamics in solids, surfaces, adsorbates, and low-dimensional systems, with particular emphasis on ultrafast processes and size effects.
- Theoretical and experimental analysis of tunnelling topography and spectroscopy in nanostructures.
- Interaction of charges and radiation with surfaces and nanostructures: nanophotonics, theory of photoemission and ion-solid interactions, and electron microscopy.

Polymers and Non-crystalline Materials

The current activities in this area are focussed on the general line: Structure and Dynamics of polymer materials and glass-forming systems. This is mainly an experimental approach by combining different techniques, in particular, neutron scattering, broadband dielectric spectroscopy and nuclear magnetic resonance. Moreover, we are also developing atomistic molecular dynamics simulations of polymer systems and coarse-grained methods as well. Within this general area, we can identify the following recent topics of research:

- Dynamics of nanocomposites and multicomponent polymer materials.
- Development of simulation methods in polymers.
- Dynamics of glass-forming polymers and the problem of the Glass Transition.
- Molecular rheology of branched polymers.
- Water-polymer interactions: a new route to approach water behavior in biological systems.
- Confinement effects in polymer blends and multicomponent systems.
- Development of new methods to dielectric characterization at nano-scale based on Atomic Force Microscopy (AFM).