Preparing the Next Generation of **FLEXIBLE ELECTRONICS**

Whether it is nanolithography, photovoltaics or printed electronics, the electronics industry is being challenged by our ever increasing need for smaller, smarter and more efficient devices. In response, the European GreeNanoFilms project was launched to advance our use of nano-structured and technical films, which are fundamental building blocks of electronics.

#Information Technology — #Energy

The GreeNanoFilms project united ten academic and industrial partners including the CERMAV, the CNRS laboratory that coordinated the project. As current technology is limited to a resolution of approximately 20 nanometers (nm), the project explored the use of carbohydrates to create higher resolution nano-structured films that would be efficient at ten nm or less.

A NEW BUILDING BLOCK FOR ELECTRONICS

Current petrol-based copolymers are inefficient when reducing size below 20nm. To overcome this challenge, the coordinator of the GreeNanoFilms project, Redouane Borsali explains: *"By using a bio-sourced carbohydrate-based copolymer called high-x, we were able to reach a resolution of ten nm or less. Increasing the resolution of thin films enables many advances such as increasing transistor performance or storage capacity in memory devices."*

THREE BROAD FIELDS OF APPLICATION

The technology created by the GreeNanoFilms project could impact three major fields of activity. First, these films will enable next generation nanolithography. The project demonstrated that this new copolymer efficiently held its nano-sized structure and characteristics over the long-range (up to several micrometers). This was a crucial step for the films to be used in real-world applications. Second, the project's research could enable the production of high-resolution biosensors. One of the challenges of detecting diseases with biosensors is the need for highly sensitive materials. Given the utlra-high resolution of the high-x copolymer, it will be possible to efficiently detect proteins and infectious cells at the molecular level.

Third, the project worked on photovoltaic applications. *"We were able to improve the domain spacing of these nano-structured thin films. Current technology uses active films where the space between elements is greater than ten nm. By dropping under the bar of ten nm, we hope to improve the transfer of electrons and therefore improve overall photovoltaic cell efficiency. We're currently testing performance levels in collaboration with the CSEM in Switzerland,"* adds Borsali.

GIANT EFFECT

Ecosystems such as GIANT and the Carnot PolyNat Institute help foster the link between industry and research. In the case of the European GreeNanoFilms project, we were able to collaborate with ten academic and industrial partners in seven countries. During the application phase, we even collaborated with the University of Texas in Austin to file a second patent for highly nano-structured thin films (under 10nm).

BORSALI REDOUANE
CNRS Research Director
GreeNanoFilms Project Coordinator
CERMAV Self-Assembly Group Leader
Director of the Carnot Polynat Institute

GOING FROM RIGID TO FLEXIBLE TECHNICAL FILMS

Another goal of the GreeNanoFilms project was to explore the use of flexible substrates, which have to be transparent, mechanically robust and super-hydrophobic. Thanks to the expertise of two project partners (CTP and VTT), the team was able to create a super-hydrophobic technical film using patented CNRS and CTP technology.