European nanotechnology project to design less toxic photovoltaic materials

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The University Institute for Advanced Materials Research at the Universitat Jaume I (UJI) has participated in the European Project Sunflower to develop less toxic organic photovoltaic materials viable for industrial production. A consortium of 17 research and business institutions carried out this nanotechnology research over four years.

Researchers at Sunflower carried out several studies, among the most successful of which was the design of a highly versatile organic photovoltaic cell that can be printed. "Thanks to this work, progress has been made in the achievement of solar cells with a good performance, low cost and very interesting architectural characteristics," says the director of the University Institute for Advanced Materials Research (INAM), Juan Bisquert.

The goals of Sunflower were very ambitious, according to Antonio Guerrero, researcher at the Department of Physics integrated in the INAM, since it was intended "not only to improve the stability and efficiency of the photovoltaic materials, but also to reduce their costs of production." In fact, according to Guerrero, "the processes for making the leap from the laboratory to industrial scale have been improved, due to the use of non-halogenated solvents compatible with industrial production methods and that considerably reduce the toxic loading of halogenates."

"The involvement of our institute in these projects has a great interest because one of our priority lines of research is the new materials to

develop renewable energies," says Bisquert, who is also professor of applied physics. In addition, these consortia involve the work of academia and industry. According to the researcher, "the transfer of knowledge to society is favoured and, in this case, we demonstrate that organic materials investigated for 20 years are already close to become viable technologies."

Change of use of plastic materials

UJI researchers at Sunflower focused on "improving chemical reactivity of materials or structural compatibility," says Germà García, professor of applied physics and member of INAM. "We have worked to move from the concepts of inorganic electronics to photovoltaic cells and organic electronics," he says. The researchers wanted to take advantage of the faculties of absorption and conduction of plastic materials and to verify the capacity of solar production, an unusual application because normally they are used for electrical insulation.

At UJI laboratories, they have studied the organic materials because they have up to eight nanometric layers. "We have made advanced electrical measurements to see where the energy losses were and thus to inform producers of materials and devices in order to improve the stability and efficiency of solar cells," explains Guerrero.

Solar energy in everyday objects

"The potential applications of organic photovoltaic technology (OPV) are numerous, ranging from mobile consumer electronics to architecture," says the project coordinator Giovanni Nisato, from the Swiss Centre for Electronics and Microtechnology (CSEM). "Thanks to the results we have obtained, printed organic photovoltaics will become part of our daily lives, and will allow us to use renewable energy and

respect the environment with a positive impact on our quality of life."

In addition, in the opinion of the investigators, the results of this research could double the share of renewable energy in its energy matrix, from 14 percent in 2012 to 27 to 30 percent by 2030. In fact, Sunflower has facilitated a significant increase in the use of solar energy incorporated in everyday objects.

Meanwhile, the main lines of research at the INAM focus on new types of materials for clean energy devices, and solar cells based on low-cost compounds such as perovskite and other organic compounds. Furthermore, INAM studies the production of fuels from sunlight, breaking water molecules and producing hydrogen and other catalytic materials in the chemical aspect, all of great importance in the context of international research.

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