FURTHER READING

Page 370, 'Antireflection Properties of Composite Zeolite Gold Nanoparticles Film', Salvatore Pullano, Svetlana Rudenko, Maksym O. Stetsenko, Lydia M. Maksymenko, I.M. Krishchenko, Volodymyr Synyuk and Antonino S. Fiorillo.

Simple fabrication of efficient antireflective nanoporous films

spin-coating antireflective films

Collaboration between researchers of the BATS Laboratory at the University Magna Gaecia of Catanzaro, Italy, the University of Tennessee Knoxville, USA and the Institute of Electro-physics and Radiation Technologies National Academy of Sciences of Ukraine, Ukraine, fabricate antireflective zeolite/Au nanoporous films using a simple spin-coating process, which could lead to facile mass production of efficient antireflective coatings.

Antireflective coatings

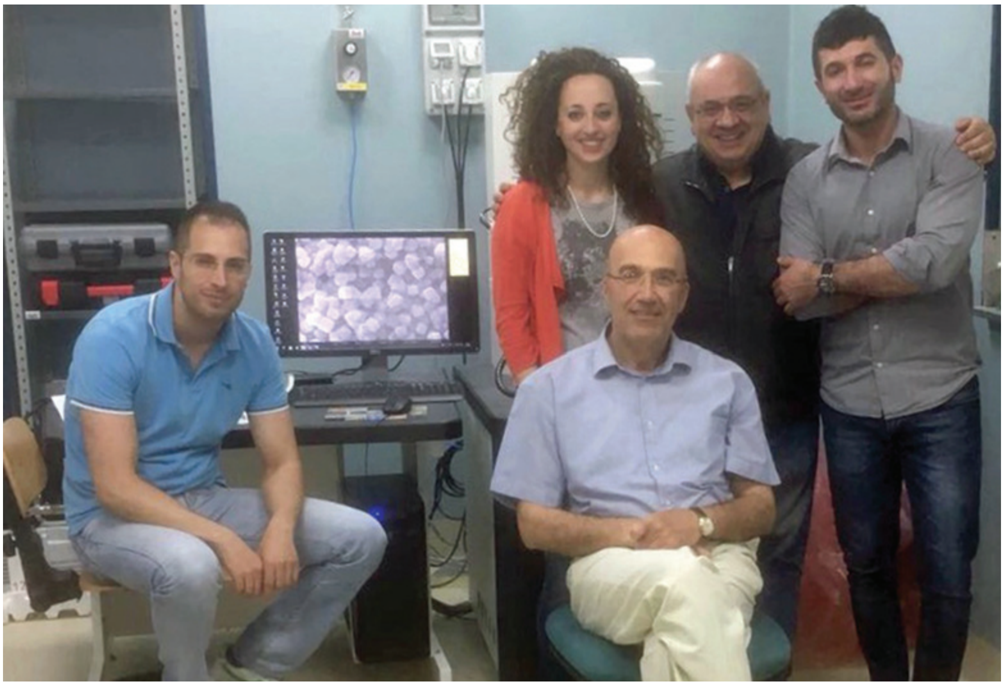
Light collection efficiency is of topical interest in the field of sensors and optoelectronic devices. Antireflection is obtained by decreasing light reflection as much as possible. In the fabrication of different devices, such as lenses or solar cells, a precise control of the interaction between the incoming light and the optical surface (*e.g.* light reflection, transmission and glare) is achieved by using suitable coatings.

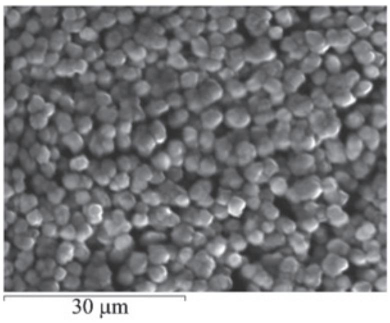
Most of the techniques that have been investigated for the fabrication of antireflective coatings focus on designing structures that produce a gradual variation of the refractive index. The optical effect of antireflection is obtained by controlling the properties of the medium in which light is travelling (*e.g.* geometry, refractive index, structure, etc.), and the antireflection of polarised electromagnetic radiation can be evaluated using modulation-polarisation spectroscopy (MPS).

Spin-coating films

In this Issue of *Electronics Letters*, researchers supervised by Professor Antonino S. Fiorillo report the improvement in antireflective properties of zeolite nanoporous films by randomly distributing Au nanoparticles into the fabricated structure. The nanoporous layer is deposited on a Si substrate using a low temperature spin-coating technique. MPS measurements show these unmodified films to possess a reflectivity of 1%. The researchers then demonstrate that the antireflective properties of the coating can be enhanced by adding plasmonic Au nanoparticles using pulsed laser deposition. The reflectivity of the zeolite/Au composite film with Au nanoparticles decreases to 0.34%, which represents a result of interest in a wide range of UV-VIS-NIR spectral measurements.

The deposition of zeolite nanoporous layers onto rigid supports, particularly onto silicon, has been previously patented by Professor Fiorillo, who is responsible for the BATS Laboratory. The fabrication process is designed to not interfere or alter the correct functioning of electronic devices that have already been fabricated on the support to be coated.





TOP: Professor Fiorillo and colleagues from the BATS Laboratory of the University Magna Gaecia of Catanzaro, Italy
BOTTOM: An SEM image of a zeolite/gold layer

The fabrication of antireflective layers often involves the use of more sophisticated processes in order to achieve a high-control on the geometry of the nanoporous film structure. The proposed technique is based on a simple spin-coating of a zeolite mixture decorated with gold nanoparticles.

Further investigations into the mixture composition and refining of the deposition process are necessary to maximise the reproducibility of the layers and reflection measurements.

"A better understanding of the influence of zeolite pore orientation with respect to the substrate is another interesting point to address" explains Pullano, a member of Professor Antonino S. Fiorillo's group.

Bio-inspired future

In the short-term, the researchers envisage that the integration of the proposed manufacturing process of nanoporous zeolite/gold coatings will make a valuable contribution to the development of novel antireflective layers in optical and opto-electronic fields. In the longer-term, establishing a fabrication process for facile mass production of efficient antireflective coatings is envisaged. Alongside optimisation of the fabrication process, the group is working on modifying the structures of the nanoporous materials to further improve the antireflective performance of coatings in the field of renewable energy.

"Over the next decade, a better fundamental understanding of the optical phenomena occurring in these antireflective coatings can help improve the performance of these materials for future applications".

The literature on antireflective coatings is full of interesting techniques that are designed to improve the performance of antireflective coatings. In particular, a better understanding may come from nature and a bio-inspired understanding of optical phenomena that occur in animals. Some of the most interesting examples of antireflective coatings derived from nature include the structural colour of peacocks, butterfly wings, insect cornea and the eyes of moths. Fully understanding these natural phenomena may help guide future researches for fabricating efficient antireflective coatings.