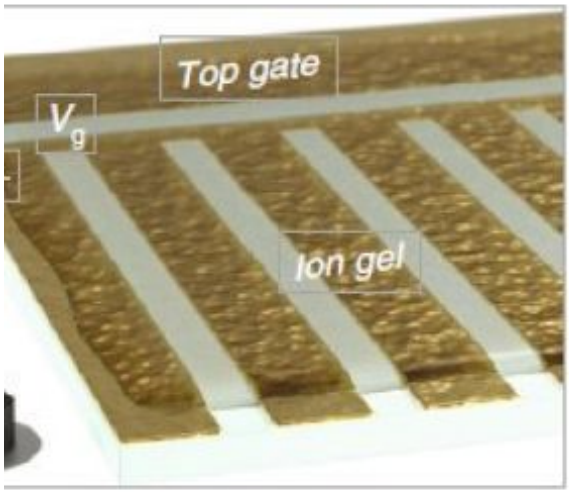

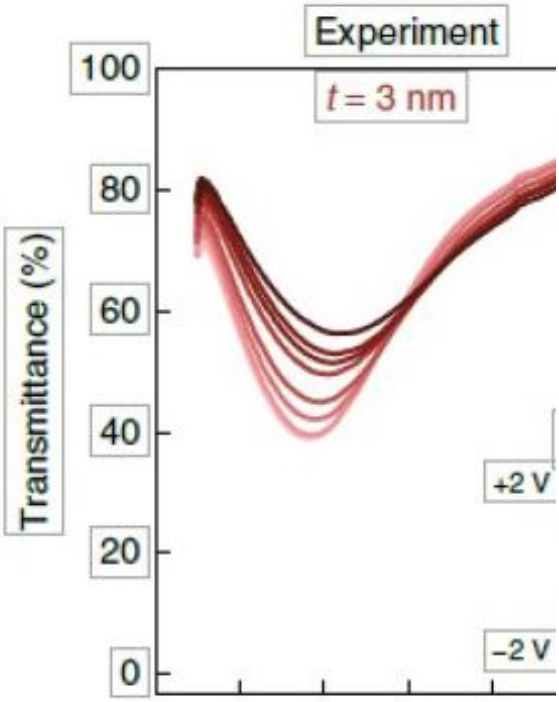

Controlling plasmons in ultrathin metal films

A way to control the plasmon behavior in ultra thin metal films.

March 26, 2019

Noble metals, such as silver and gold, in nano-particle geometry have been used to color glass since ancient times thanks to the plasmonic effects. Plasmonic interactions between electrons and photons change significantly in materials when one or more of the dimensions of the object are reduced down to the nanometer scale.

Ultrathin metal films (UTMFs) that have an atomic thickness have been theoretically predicted to produce two-dimensional plasmonics. However, so far, this has been experimentally hard to achieve and study because of the difficulty in producing large areas of sufficiently thin continuous films.

Now, in a recent study published in Nature Photonics, ICFO researchers Rinu Abraham Maniyara, Daniel Rodrigo, Renwen Yu, Josep Canet-Ferrer, Dhriti Sundar Ghosh, led by ICREA Professors at ICFO Valerio Pruneri and Javier Garcia de Abajo, in collaboration with the Corning Research and Development Corporation unit at Corning Inc., have found the way to overcome this issue.

In their study, the team of researchers demonstrated that UTMFs with a sufficiently low nanometric thickness support plasmons with new dispersion regimes. In particular, they also were able to electro-optically tune the plasmons using a method called electrical gating. The study was possible thanks to a novel deposition technique in which they used copper as a seed layer to produce large areas of gold UTMFs. The technique, attained through physical vapor deposition, overcomes the problem of island-like growth of unseeded gold at small thickness, giving rise to percolated films, and has the key advantage of being industrially scalable.

New plasmonic geometries, combined with large-scale fabrication feasibility, and deeper understanding of the tuning mechanism will potentially lead to applications that range from smart windows, plasmon-enhanced spectroscopy, to optical biosensing, and electrochromic devices, to name a few.