Ultrashort laser ablation enables novel metal films

September 21 2010

Laser ablation is well known in medical applications like dermatology and dentistry, and for more than a decade it has been used to vaporize materials that are difficult to evaporate for high-tech applications like deposition of superconductors. Now researchers in the *Journal of Applied Physics*, which is published by the American Institute of Physics have studied the properties of femtosecond laser ablation plumes to better understand how to apply them to specialized films.

Salvatore Amoruso at University of Naples, Italy and colleagues examined the expansion dynamics of various ultrashort laser ablation plumes and the basic properties of the complicated ablation process in which some material is vaporized in the form of plasma and some in the form of nanoparticles. The team studied the shapes of both the plasma and nanoparticle plumes, which are important for pulsed laser deposition of nanoparticle films.

Nanoparticle silver and gold films made by pulsed laser deposition are useful for optical applications such as surface-enhanced Raman spectroscopy. Nanoparticle films of transition metals such as iron, nickel, or cobalt may be used to catalyse the growth of carbon nanotubes.

"We can understand our results in terms of some existing models of plume expansion," says co-author James Lunney at Trinity College Dublin, Ireland. "We also see evidence that the pressure in the plasma plume has an influence on the expansion of the nanoparticle plume.

Analysis of these expansion dynamics may also improve our physical understanding of the overall ablation process."

More information: The article, "Dynamics of the plumes produced by ultrafast laser ablation of metals" by Salvatore Amoruso (Universita di Napoli Federico II), Tony Donnelly, James G. Lunney (Trinity College Dublin), Riccardo Bruzzese (University degli Studi di Napoli Federico II), Xuan Wang (University di Napoli Federico II) and Xiaochang Ni (Tianjin University) appears in the *Journal of Applied Physics*. link.aip.org/link/japiau/v108/i4/p043309/s1

Provided by American Institute of Physics