**The Department of Materials Science and Engineering invites you to join us for an upcoming Seminar:**

Arseniy I. Kuznetsov and Aleksandr V. Ovsianikov
Laser Zentrum Hannover e.V., Hollerithallee 8, 30419 Hannover, Germany

# TITLE: When it Rains Gold on Microspiders
# 2D and 3D Nanostructuring with Femtosecond Lasers

**Date:** Monday, March 23, 2009
**Time:** 4:00 to 5:00 PM
**Refreshments:** 3:30 to 4:00
**Room:** Wilsdorf 101

ABSTRACT: Femtosecond lasers are excellent tools for micro- and nanostructuring of nearly all kinds of solid materials. The main features of femtosecond laser processing are: (i) efficient, fast and localized energy deposition, (ii) low deformation and ablation thresholds, (iii) minimal thermal and mechanical damage of the processed material.

In this seminar, two principally different approaches for laser nanostructuring of metals and polymers will be presented. The first part is devoted to nanotexturing of gold films through laser-induced melting. This method can be applied for fabrication of various nanostructures on the film surface with resolution as high as 100nm (Fig.1a). Furthermore, it provides important insights into the nature of ultra-fast melt dynamics. Shape of the created structures can be set by adjusting the applied intensity distribution. The same approach can be used for the controlled transfer of gold nanodroplets to another substrate (Fig.1b).

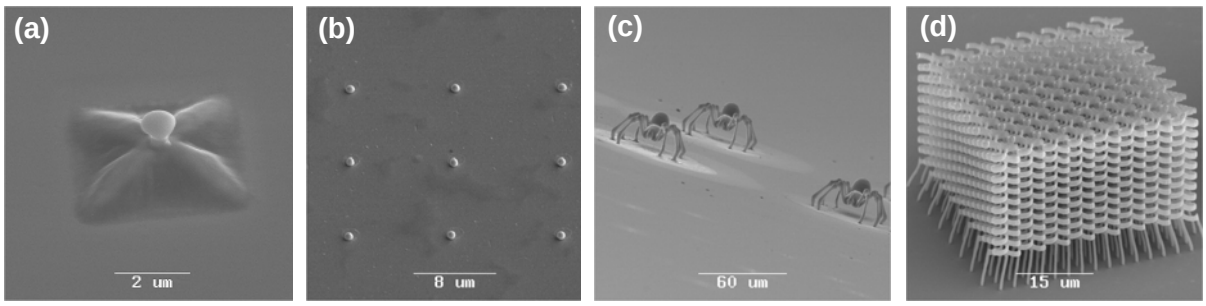


Fig. 1 (a) Structure fabricated on a 60-nm gold film surface under irradiation by a single femtosecond laser pulse with a square-shaped beam profile. (b) Spherical gold nanodroplets transferred onto a glass substrate by laser-induced melting of a 60-nm gold film. (c) An array of microspiders fabricated by two-photon polymerization. (d) A spiral-based 3D photonic crystal fabricated in organic-inorganic hybrid photopolymer.

A second method presented in this seminar is two-photon polymerization **(2PP).** Here laser radiation is used to induce a highly localised photochemical reaction leading to polymerization of the material. By moving the laser focus within the volume of the photosensitive material, fabrication of any computer generated 3D structure is possible (see Fig.1c&d). The nonlinear nature of the interaction allows true 3D microfabrication and realisation of structures with submicrometer resolution. Virtually any “photopolymerizable”, purely organic or organic-inorganic hybrid, materials can be processed by this approach. Current applications of this technique extend from photonics to MEMS and biomedicine. In this presentation, our recent advances in two-photon activated laser processing, properties of

used materials, and applications of this technology are discussed. The presentation is supported by numerous examples of fabricated structures.