



## **Laser Induced Deformation and Structural Modification of Crystalline and Amorphous Materials**

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**Mechanical Engineering, SEAS**

Micro-scale laser shock peening (LSP) is a surface treatment which has a goal to improve fatigue life of metallic micro components subject to cyclic loading. For micron-sized laser beams, the size of the laser-target interaction zone is of the same order of magnitude as the grains of the most commonly used metals such as copper, aluminum and nickel. Thus the target material must be considered as being anisotropic and inhomogeneous. Single crystals are chosen to study the effects of anisotropy and bicrystals for investigation of heterogeneity.

Theoretical and experimental aspects of LSP are studied. In addition, a finite element model which considers inertial and strain hardening effects is developed to investigate the dynamic response of materials during the LSP process.

Non-linear absorption of femtosecond laser pulses enables processing of the interior of bulk transparent dielectrics without affecting their surface. Features are generated in the interior of glass samples through the employment of single laser pulses as well as pulse trains. The nature of the physical mechanisms responsible for the alteration of material properties is investigated. The illumination point spread function was utilized for the first time to quantify the morphology of the produced features. It is also experimentally shown that, even with a lower numerical aperture, cavities can be formed in the interior of glass if a single laser pulse with energy in the micro joule range is deposited into the material. Cross-sections of the induced features were examined via the decomposition of spatially resolved Raman spectra and a new method for the quantitative characterization of the structure of the amorphous fused silica is proposed.



**Sinisa Vukelic** is a Ph.D. candidate at Mechanical Engineering Department at Columbia University currently working in the Manufacturing Research Lab under supervision of Profs. Y. Lawrence Yao and Jeffrey W. Kysar. He received his Dipl. Ing. from University of Belgrade and masters degree from Columbia University.

**FRIDAY, March 6, 2009**

**10:00 am Seminar in 233 Mudd**

**Breakfast at 9:30am in MECE lobby**