NanoLab Talk

Monday, 21st may, 2018 – 15.00

Seminar Room 1° floor

Department of Energy – Cesnef (Building 19) via Ponzio 34/3 Milan

Politecnico di Milano

"On the growth dynamics of low-density carbon foams in Pulsed Laser Deposition experiments"

Alessandro Maffini

NanoLab – Department of Energy

Politecnico di Milano

Abstract:

Ultra-low density porous materials (1-20 mg/cm^3, also known as "foams") show unique appealing features, such as a nearly perfect black body behaviour and an extremely high surface-to-volume ratio. Among them, carbon (C) foams have attracted great interest in cutting-edge research topics such as the generation of hadron beams via laser-plasma acceleration schemes.

The Pulsed Laser Deposition (PLD) technique is an ideal tool to obtain ultra-low density coatings with finely tuned properties. In particular, it has been shown that it is possible to produce C foams exploiting the peculiar PLD regime characterized by nanosecond pulses and high background pressure (up to 1000 Pa). While it is well understood that PLD C foams are essentially fractal-like aggregates of C nanoparticles, a satisfactory description of the foam growth process is still lacking.

In this talk, I will present a combined experimental and theoretical investigation about the physics of foam growth in PLD experiments. In particular, we have explored the role of different PLD process parameters (e.g. number of shots, laser repetition rate, target-to-substrate distance) on the properties of the growing foam. Basing on this analysis, we have developed a model that describes the aggregation of C nanoparticles as a "in-flight" diffusion-limited process in which the time scale is determined by the propagation of laser generated shock waves. These results, along with their interest from a fundamental point of view, could open new perspectives in the pulsed laser deposition of low density materials.

For further information: carlo.casari@polimi.it