**The generation of nanoparticles and thin films using pulsed high-power plasmas**

Ulf Helmersson, Dept. of Physics, Linköping University, Linköping, Sweden

[ulf.helmersson@liu.se](mailto:ulf.helmersson@liu.se)

The use of pulsed plasma methods makes it possible to use extremely high plasma densities at low-pressures in the synthesis of nanostructures such as nanoparticles and thin films. For nanoparticle syntheses this is of great interest since low-pressure plasma methods opens up the potential for design of a diversity of nanoparticles directly followed by the distribution of the generated nanoparticles on surfaces or in the assembly of the nanoparticles into nanostructures using guiding electric or magnetic fields. Electric field can be used since nanoparticles in a plasma generally attains a negative potential, while magnetic fields require that the nanoparticles have ferromagnetic properties. In this presentation, the role of the ionization of the material for the increased nanoparticle productivity, will be discussed and results of nanoparticle assembly into pillars, nanowire and nanotrusses, will be presented.

For thin film synthesis the main reason for the interest in, high-power impulse magnetron sputtering (HiPIMS) is, as for nanoparticles, the ability to ionize the deposition material. Ions can be controlled and their energy and deposition flux can be tuned, obtaining improved film properties, such as higher density, better coverage of complex shaped substrates, better adhesion and phase control. HiPIMS also have another potentially very interesting feature - the control over the temporal flux of deposition species and their energy. Different ion species will arrive at the substrate at different time after the onset of the HiPIMS pulse due to different time of generation and different time of flight. This can be utilized and the substrate bias can be set to accelerate one set of the ion species at will.