OR1603

# A versatile magnetized pulsed cascaded arc source for deposition of nano-structured oxides at high rates

Gregory De Temmerman[1], Jakub Zielinski[2], Thomas Morgan[2], Richard van de Sanden[2]

[1]FOM-DIFFER, Nieuwegein, Netherlands [2]FOM Institute DIFFER, Nieuwegein, Netherlands

g.c.detemmerman@differ.nl

Nanoparticles and nano-structured surfaces are of paramount importance in various fields of material-related research. For example, the successful deployment of solar fuels, i.e. photo-activated generation of hydrogen or hydrocarbons, relies on the development of nano-structured catalysts with well-defined properties in terms of light management and selectivity towards the required product. Most of the current research is based on precise control of the material structure neglecting the production efficiency or output. Large-scale deployment of nanostructured materials, however, depends on the availability of high-throughput methods ensuring mass production at the lowest possible cost.
The so-called cascaded arc source, which has been extensively used for thin film deposition by PECVD has been upgraded to allow for high power pulses (1ms duration) superimposed on the DC plasma. One of the cathodes is made of the feed material and used for the generation of the pulsed plasma- the other cathodes remain powered by the DC plasma only. The system is installed inside magnetic coils allowing a confinement of the plasma beam. Metal oxide deposition (copper, aluminium) occurs on a temperature-controlled substrate facing the plasma expansion.
Depending on the operating conditions (input power, gas flow, B field), isolated nano-particles or nano-structured films can be deposited. The size distribution of the deposited particles peaks at about 12 nm and is very narrow- no particles larger than 25 nm are observed on the whole surface for both copper oxide and aluminium oxide. The highest observed film deposition rate is 50nm/pulse, which is an order of magnitude higher than the highest rate reported by HiPIMS deposition. With a possible deposition rate of 10Hz, the system combined unprecendented deposition rates and the possibility of in-situ processing between pulses.

**Keywords**
nanoparticles
pulsed plasma
deposition rate