FINAL MASTER PROJECT PROPOSAL

Title

Pt-based deposits grown in cryogenic conditions by Focused Ion Beam Induced Deposition (Cryo-FIBID) for applications in Nanoscience

Supervisor(s)

JOSE MARIA DE TERESA NOGUERAS (deteresa@unizar.es)

Summary of the project

The student will develop a TFM work focused on the growth of Pt-based deposits by Focused Ion Beam Induced Deposition (FIBID) in cryogenic conditions, technique coined Cryo-FIBID. In FIBID, a precursor gas is inserted in the chamber, $(CH_3)_3PtCpCH_3$ in this case, and the FIB scan produces the precursor dissociation and gives rise to a Pt-based deposit (see image below). Pt-based deposits grown by FIBID have currently important applications for circuit editing and mask repair in Semiconductor Industry, and for lamellae preparation and electrical contacting of nano-objects. One limitation of this technique is the low growth rate. The supervisor has recently submitted a patent on the increase of the growth rate in three orders of magnitude by using Cryo-FIBID instead of standard FIBID. The proposed TFM work will explore the applicability of such idea for the growth of Pt-based deposits, which could have a great impact in the applications previously mentioned. The TFM work will be mainly experimental and will be developed using the infrastructure of the Laboratory of Advanced Microscopies at Institute of Nanoscience of Aragón at University of Zaragoza. The student will use:

1) state-of-the-art Focused-Ion-Beam (FIB) equipment, to grow Pt deposits by Cryo-FIBID. An existing cryo-setup will allow the student performing the FIBID growth under cryogenic conditions. The growth parameters will need to be optimized to reach the target of obtaining Pt cryo-deposits with high electrical conductivity (better than 1 mΩcm) and high lateral resolution (below 100 nm).
2) energy-dispersive spectroscopy technique inside an Scanning Electron Microscope (SEM) to analyze the composition of the grown deposits
3) an electrical micro-probe station to obtain the electrical conductivity of the grown deposits

With this TFM work, the student will be trained on important experimental techniques in Nanoscience: the use of FIB-SEM microscopes, the growth of materials by Cryo-FIBID, the compositional characterization by energy-dispersive spectroscopy and the electrical characterization by means of an electrical micro-probe station.