TARGETS FABRICATION USING FILMS DEPOSITIONS FOR HIGH-PRESSURE PLANETOLOGY STUDIES

Nicolas Coudurier*[1]

[1]Institut de minéralogie, de physique des matériaux et de cosmochimie (IMPMC) – Museum National d'Histoire Naturelle, Université Pierre et Marie Curie - Paris 6 : UM120, Institut de recherche pour le développement [IRD] : UR206, Centre National de la Recherche Scientifique : UMR7590 – Tour 23 - Barre 22-23 - 4e étage - BC 115 4 place Jussieu 75252 PARIS, France

Abstract

The ERC Planet Dive aims at providing experimental references for phase diagrams, equations of state and melting properties of planetary materials up to the TeraPascal pressure range (1 TPa = 1012 Pa = 10 Mbar). Two mains issues have been identified in order to complete successfully this task:
-A large range of sample with various chemical compositions (Fe, Si, Mg, Ca elements carbide and oxide alloys) and crystalline state is necessary for the planetary materials study.

-The multilayer targets fabrication needs to be perfectly control in order to monitor the compression evolution into the sample at such pressure and to obtain results repeatability.

To answer to this challenge, IMPMC has made the choice to develop thin films deposition and characterisation. Magnetron sputtering process allows reaching good stoichiometric control of the alloys deposits. Moreover, O2 or N2 partial pressure could be added to the argon gasflow reacting in the plasma to obtain oxydes or nitrides of metallic sample. Fe, FeOx (figure 1), FeSixCy, and MgFexOy depositions has been achieved with the reactive sputtering.

Another process used, the electron beam PVD (Physical Vapor Deposition) allows us the deposition of oxydes (AlOx, CaTiO3) and salts (LiF, KCL) from solid precursors. Thin metal or Parylen (with another process) layers could also be deposit on the multilayer assembly as an ablator.

Ion polishing or FIB (Focused Ion Beam - figure 1) are used to obtain high-quality cross-section for the SEM or TEM observations. A confocal/interferometer microscope allows us to obtain 3D image and surface rugosity of the sample. Easy thickness monitoring of the sample can also be reached with this technique.

*Speaker