Strucuture of microlamp´s protective layer under polarization

V.R.S. Cassimiro[a] , M.C.A. Fantini[a], R.M. Cunha Júnior[b], G.P. Rehder[b], I. Pereyra[b], M.N.P. Carreño[b], M.I. Alayo[b], N. Trcera[c]

[a] *Instituto de Física, Universidade de São Paulo, São Paulo, Brazil.*
[b] *Escola Politécnica, Universidade de São Paulo, São Paulo, Brazil.*
[c] *Soleil, Lucia Beamline, Gyf-sur-Yvette, France.*

Microlamps have many applications as lightening for infrared micro spectroscopy and localized thermal treatment sources. The main objective of this work was to build microlamps and to analyze the structural modifications induced on the protective layers of the metallic filament by the heating process. Their production consists on films deposited by Plasma Enhanced Chemical Vapor Deposition (PECVD) and sputtering over silicon substrates [1-4]. The filament, composed by a thin chromium wire, is protected against oxidation by a top thin layer. Four different materials were used as protective layer: SiC, SiO_xN_y, AlN and TiO_2. The protective film is heated by the metallic filament and their chemical and structural properties may change, depending on the time interval and intensity of the applied current (up to 2h and 50mA). X-ray absorption near edge spectroscopy (XANES) measurements allowed investigating changes on the properties of the microlamp´s protective films heated under different polarization conditions. The LUCIA beam line of the synchrotron SOLEIL has a microfocus spot (3x3μm), permitting to evaluate the small thermally affected zone. The results showed that SiO_xN_y film is thermally stable with negligible changes on the XANES spectra. A slight AlN oxidation is observed as heating rises which is particularly evident for the sample heated at extreme conditions. TiO_2 XANES spectra showed that the material is crystallized on rutile structure and is also thermally stable. SiC thin films, showed in Figure 1, were widely affected showing an oxidation process as the time interval and intensity of the current increase. In addition, once the films were deposited over the Cr filament, their XANES spectra are quite different from the standard sample (deposited over Si), even for the non-polarized microlamp, indicating a Cr contamination on the SiC structure. For technological purposes, the SiO_xN_y and TiO_2 films are suitable as filament protective layer due to their high thermal stability.

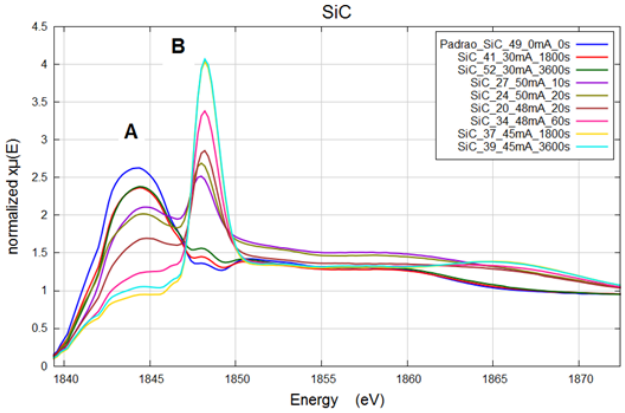

Figure 1: XANES spectra of SiC protective films under polarization.

[1] G. Rehder et al. Journal of Non-Crystalline Solids, 354 (2008) 2538.
[2] M.I. Alayo et al. Journal of Optics. A, Pure and Applied Optics 10 (2008) 104022-1.
[3] A.H. Gollub et al. In: Photonics West 2010 Proceedings of the International Society for Optical Engineering - Photonics West 7590 (2010) 75900E-1.
[4] H. Baez, M.I Alayo. In: Photonics West Proceedings of the International Society for Optical Engineering - Photonics West 7940 (2011) 79401I-1.

Acknowlegments: Thanks are due to FAPESP and CNPq for the financial support.