

Effect of X-ray irradiation on Co-Phthalocyanine thin films studied by Surface Plasmon Resonance

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Abstract

We present here, *in situ* and in real time, the effect of X-ray irradiation (7.7 keV) on Co-Phthalocyanine (CoPc) thin films using Surface Plasmon Resonance (SPR) as a probe. For that, Au/CoPc bilayers were grown in an organic molecular beam epitaxy system. CoPc films with different thickness and growth temperature were analyzed. Simultaneous X-ray irradiation and SPR measurements were performed at the branch A of the BM25 SpLine beamline at The European Synchrotron (ESRF) in Grenoble, France, using a SPR instrument specifically designed for this type of experiments [1]. This set-up follows the Kretschmann–Raether configuration for SPR [2] and its sensitivity allows detecting relative variations in the SPR curve of the order of 10^{-3} – 10^{-4} . The very high sensitivity of SPR to slight modifications of the dielectric media allows tracking the small changes of refractive index induced by the irradiation in the organic films.

We have found a small and partially reversible modification of the SPR spectra of CoPc in CoPc/Au bilayers upon irradiation. For a beam intensity of $\sim 10^{11}$ photons·s⁻¹·mm⁻² and an irradiation time of the order of 1 h, we estimate small variations of the order of a few % in the refractive index related to the scattering of the X-rays with the soft matter. A Raman study of the irradiated regions did not show structural modifications, suggesting that the observed variations in the optical properties of the CoPc films are associated with modifications of their electronic configuration.

References

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