

Structural Characterization of Cobalt Tetrasulfonated Phthalocyanine Immobilized in Nanostructured Thin Films

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Abstract – Cobalt tetrasulfonated phthalocyanine (CoTsPc) was immobilized in the form of layer-by-layer (LbL) thin films in conjunction with different polyelectrolytes. Several characterization methods were used to investigate the structure of the films, including UV-visible and FTIR spectroscopies, atomic force microscopy (AFM) and surface plasmon resonance (SPR). These measurements revealed the influence of the layered architecture of the film on the arrangement of the phthalocyanine molecules, which influences the overall performance of the systems as electrical or electrochemical sensors.

Metallophthalocyanines (MPcs) are macrocyclic compounds which exhibit outstanding physical and chemical properties, like intense color, thermal and chemical stability and well defined redox activity. These features allowed their application in several fields of science and technology, including photocatalytic and electrochromic devices, optical data storage media, and analytical sensors for a broad range of substances, from gases to biological molecules^[1]. The goal of this study was to characterize two systems which are suitable for analytical detection. These systems consist of thin films containing cobalt tetrasulfonated phthalocyanine and a polycation (poly(allylamine hydrochloride) or poly(amidoamine)) immobilized through the layer by layer technique. Measurements of UV-visible spectroscopy revealed a linear deposition of the phthalocyanine ring in both cases. FTIR (Fourier transform infrared spectroscopy) analysis showed the effect of the LbL architecture on the interaction of the constituents of the films; the shift in the band at 1036 cm^{-1} (assigned to the SO_3 group from CoTsPc) is an evidence of the electrostatic attraction between sulfonic groups of the phthalocyanine and amine groups of the polycations^[2]. Atomic force microscopy images revealed a columnar growth of the films, especially for the dendrimer-containing films. Surface plasmon resonance provided information about the kinetics of film growth, association and dissociation constants and thickness of each adsorbed layer, as shown in figure 1. This set of measurements point out to the possibility of developing sensors whose active element could reproduce the systems described above.

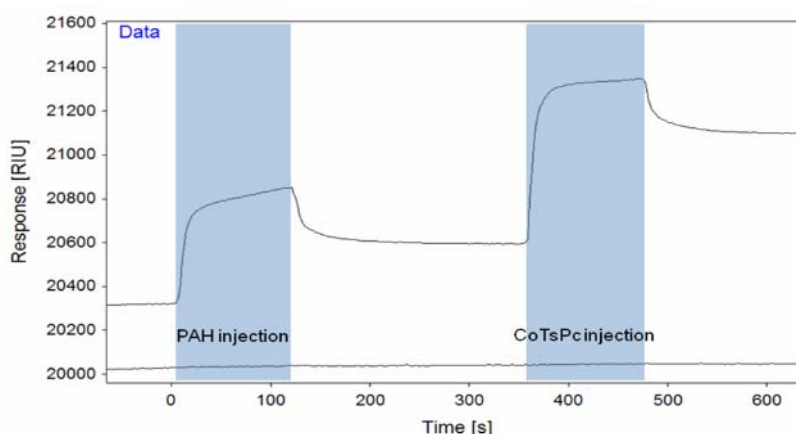


Figure 1: SPR measurements showing the kinetics of adsorption of PAH and CoTsPc layers.

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