Chemical functionalization of inorganic surfaces for organic LEDs applications

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Chemical modification of inorganic surfaces with silane molecules is commonly used for the development of functional surfaces for various applications [1]. In this study, the functionalization of inorganic surfaces (silicon, GaN) was achieved using a three-step chemical deposition method. First, the surfaces were cleaned by sonication in different solvents followed by the formation of a silicon dioxide layer by immersion in a freshly prepared piranha solution. Finally, an organosilane was deposited on the surfaces in the form of a self-assembled monolayer. The pristine surfaces, as well as those treated with piranha solution and those after APTES/APDMES deposition, were analysed by contact angle (CA) measurements, atomic force microscopy (AFM) and X-ray Photoelectron Spectroscopy. The static water CAs and AFM suggested the presence of the silane molecules on the inorganic surfaces. XPS analysis showed the presence of Si, O and C on all surfaces, whereas, N was only visible on the APTES treated surfaces, attributed to the primary amino groups of the silane molecule (Fig.1A). In the case of the surface modified with APDMES the N peak is hardly observed since it is in the detection limit of the technique. Fig.1B shows the deconvolution of the N1s spectra for the APTES modified sample in two N_A and N_B peaks, where N_A is attributed to the free amino groups and N_B is due to the protonated amino groups. The N_A/N_B ratio increases from 1.3 to 2.55 when the surface sensitivity of XPS is increased by turning the sample by 45°. From this it is concluded that the protonated amino groups are oriented close to the Si surface, whereas the free amino groups are positioned closer to the free surface [2].
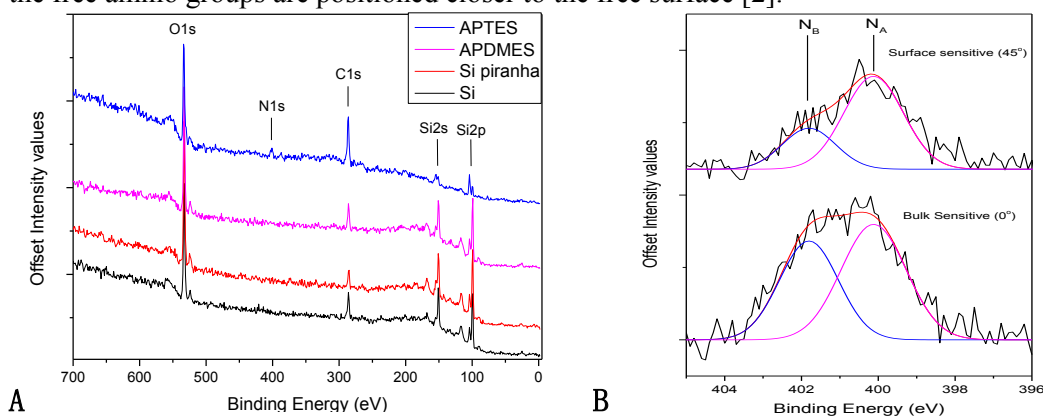

Figure 1: A) Wide scan survey spectra for all the surfaces. B) Deconvolution of the N1s spectra in the APTES modified Si surface.

References

[1] J. Lopez-Gejo, A. Arranz, A. Navarro, C. Palacio,E. Munoz and G. Orellana, JACS 132, 1746 (2010)

[2] E. Vandenberg, L. Bertilsson, B. Liedberg, K. Uvdal, R. Erlandsson, H. Elwing and I. Lundström, Journal of Colloid and Interface Science 147, 103 (1991).

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