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Surface Structure and Reactivity Study of Phosphotungstic Acid-Nitrogenated Ormosils

Elias P. Ferreira-Neto, Flavio L. S. de Carvalho, Sajjad Ullah, Vinicius C. Zoldan, André A. Pasa, Adriano Lopes de Souza, Liliane C. Battirola, Petra Rudolf, Sara Aldabe Bilmes, Ubirajara P. Rodrigues-Filho

Supporting Information

S.1. Atomic Force Microscopy

The Root Mean Square (RMS) parameter, R_{rms} , is defined as:

$$R_{rms} = \sqrt{\frac{1}{MN} \sum_{k=0}^{M-1} \sum_{l=0}^{N-1} [z(x_k, y_l)]^2}$$

The Surfaces Area Ratio, Sdr, expresses the increment of the interfacial surface area relative to the area of the projected (flat) x,y plane:

$$Sdr = \frac{\left(\sum_{k=0}^{M-2} \sum_{l=0}^{N-2} A_{kl} \right) - (M-1)(N-1)\delta x \delta y}{(M-1)(N-1)\delta x \delta y} 100\%$$
$$A_{kl} = \frac{1}{4} \left(\left(\sqrt{\delta y^2 + (z(x_k, y_l) - z(x_k, y_{l+1}))^2} \right) + \left(\sqrt{\delta y^2 + (z(x_{k+1}, y_{l+1}) - z(x_{k+1}, y_l))^2} \right) \right. \\ \left. + \left(\sqrt{\delta x^2 + (z(x_k, y_l) - z(x_{k+1}, y_l))^2} \right) + \left(\sqrt{\delta x^2 + (z(x_k, y_{l+1}) - z(x_{k+1}, y_{l+1}))^2} \right) \right)$$

For a totally flat surface, the surface area and the area of the xy plane are the same and Sdr = 0 %.

Figure S2: X-ray photoemission spectrum of ormosil-A: W $4f$ and $5p$ core level region