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Contribution to the improvement of the properties of SiO2-based polymer composites materials

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In recent years, silica has found interesting applications in a variety of disciplines including concrete, catalysis, clean technology, separations science and microelectronics devices. Silica is also a good candidate as filler in composite polymers. In fact, polymer composites are the advanced materials alternative to traditional materials such as metals or ceramics and consist of at least two constituents of different phase, one of them being continuous polymeric matrix phase and other is reinforcements (fibers, filler). The interaction between the filler and the polymer matrix is a key to the properties of the polymer composites. The control of the interface of the filler is very important without the addition of the chemical agent. Although it is challenging to determine the true surface of SiO2 compounds in order to avoid hazardous additions. The specific aim of this work is to study the dependence between structure, surface state and reactivity of silica for different heterogeneous SiO2 compounds and evaluate the behavior of their surface subject to chemical stress, to increase the reactive ability of their surfaces to be able to interact with the molecules of modifiers. The surface morphology of silica is examined by Variable Pressure Scanning Electron Microscope (VP-SEM) and showed the original fibrous surface of silica quartz. The FTIR frequency shift of the bridging oxygen stretching vibration Si–O–Si is observed and the intensity ratio between the Si-OH band and Si-O-Si increases is determined. Furthermore, X-ray diffraction showed that the quartz lattice was conserved during the treatment with a shift of the main peak 101 in agreement with the infrared results on the Si-O-Si peak shift and the increase in the intensity ratio of Si-OH/Si-O-Si. The phase obtained will be used to prepare polymer composites with high thermal and mechanical performances.

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