

Characterization of different types of silica-based materials

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Glasses based on the silicon dioxide (silica) are able to retain their properties even when recycled and therefore belong to the one of the most demanded secondary raw materials. Regardless of their type, these waste glasses are commonly referred to as Si-based secondary raw materials. However, depending on the source of original waste, the properties and composition of milled glass powders vary affecting further usage. Therefore, a comprehensive characterization is essential in some cases.

In this study we investigate several commercially available silica-based granular materials (powders). These materials were analyzed in terms of their surface and/or bulk modification by plasma treatment, annealing or chemical processing. In particular, powders were characterized using attenuated total reflectance Fourier transform infrared spectroscopy, infrared Raman spectroscopy, energy-dispersive X-ray spectroscopy, the X-ray photoelectron spectroscopy, etc. The differences found in the primary structure of SiO₂ particles (amorphous vs crystalline) and the impurities content were considered as determinative factors for particles' surface modification (e.g. by hydroxyl groups). These results provide a fundamental background that contributes to a better understanding and explanation of the interaction reactions of Si-based secondary raw materials used as fillers in alkali-activated cement-based composite materials.

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