**Organofunctional Silica Nanomaterials For Energy And Environmental Applications**

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Sol-gel derived functional silica-based aerogel-like materials and hybrids comprise an important class of porous materials that are widely employed in many applications due to their highly developed porous network, ease of functionalization, mechanical/ chemical/thermal stability, and recyclability. Thanks to the versatility of sol-gel chemistry, surface properties and microstructures of silica aerogels can easily be tuned by incorporating organic moieties into inorganic skeleton. These hybrid structures benefit from the functionality of the organic groups and the high surface area and stability of the inorganic silica host. So far, our research concentrated on the numerous ways of target-specific functionalization of silica aerogels/xerogels for diverse energy-related, environmental and biomedical applications. We have developed methyl, ethyl, vinyl, methacrylate, epoxide and amine functionalized silica aerogels by incorporating organosilanes in-situ to the sol-gel reactions. In those studies, chemical and structural variations induced by the added organic functional groups to the silica skeleton and their impact on the micro- and macroscopic properties were characterized by various techniques such as IR spectroscopy, ssNMR spectroscopy, $N_2$ porosimetry, scanning electron microscopy, small- angle neutron and X-ray scattering, thermogravimetric analysis and contact angle measurements. Functionalized silica aero/xerogels were utilized both as efficient adsorbents with high sorption capacity and reusability for the removal of oil, organic solvents and pharmaceutical compounds from wastewater in environmental remediation applications and as thermal insulators with effective thermal conductivity values lower than 45 mW/mK in energy-saving applications. Due to their super hydrophobicity ($\Theta$>150°) they prove to be effective as bacteria-repelling barriers for potential health-care-related applications.

**Keywords**: silica aerogels-xerogels, organic functionality, thermal insulation, environmental remediation

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