FROM GELS TO AEROGELS: CREATING MULTIFUNCTIONALITY VIA SOLVENT REMOVAL

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Gels containing water or other solvents abound in applications with considerable efforts being made to fabricate new ones with enhanced functionalities. An area that remains less explored is the creation of aerogels by replacing the liquid matrix of gels with air. Can we preserve the structure of these systems on liquid removal and can we create materials that are just as versatile by doing so? We attempt to answer these questions by presenting a facile and sustainable solid templating approach to fabricate highly porous, flexible and superhydrophobic aerogels of composite nanofibers of cellulose acetate and silica which are produced through sol gel electrospinning. Scanning Electron Microscopy helps us to understand the architecture of these aerogels which consists of large secondary pores in the size range of 30-50 mm interconnected by a network of entangled nanofibers with 2-5 mm primary pores. In contrast to many other highly porous substances, these aerogels have very low densities (5-8 mg/cm^3) in combination with flexible structure. Thermal crosslinking of the aerogels further stabilizes their structure and flexibility without compromising on porosity. Thermally crosslinked aerogels display superhydrophobicity while maintaining high absorption affinity for oils. In-situ Fourier Transform Infrared spectrometry and X-ray Photoelectron Spectroscopy are used to understand the structural features of the resultant aerogels while thermal studies demonstrate enhanced thermal stability and flame retardancy. Ease of processing, thermal stability, high porosity, superhydrophobicity and superoleophilic nature of these aerogels make them just as promising, if not more, than their liquid-based analogs!