Modeling the hydration effects in aerogels

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There has been a recent interest in understanding the effects of hydration on the structural and mechanical properties of aerogels. Antonyuk *et al*. [1] presented a report on the mechanical behavior of dry and wet alginate-starch aerogels where a pronounced stiffening with an increasing degree of wetting was observed. To explain this phenomenon, a network decomposition model was proposed by Rege *et al*. [2], where the material network was decomposed into a hydrogel-like one and a hydrated aerogel one. The focal points of the aerogel network, where the hydrogel-like local clusters are considered to be formed, was determined by correlating the degree of hydration with the relative pore area. The proposed model is in good agreement with the experimental data on alginate aerogels. Recently, the hydration mechanism of gelatin containing hybrid aerogels was investigated by means of a combination of nuclear magnetic resonance (NMR) spectroscopy and small angle neutron scattering (SANS) techniques [3]. Such experiments have also been performed on alginate-based aerogels and show the significant rearrangement of the aerogel backbone due to its hydration and the formation of extensively hydrated regions in the focal points of the solid network. The new model results and corresponding experimental findings, as well as a correlation between the two, will be presented.

References

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