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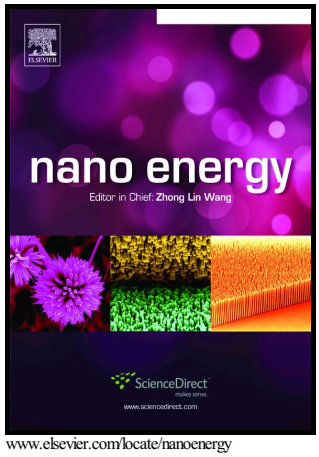

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Abstract

Experimental realization of optically transparent and mechanically robust and flexible aerogels have been longstanding challenges, limiting their practical applications in energy-saving devices, such as thermally insulating films for enhancing energy efficiency of windows. The poor transparency precluded even hypothetical consideration of the possibility of birefringent aerogels. We develop birefringent and optically isotropic aerogels that combine properties of thermal super-insulation, mechanical robustness and flexibility, and transparency to visible-spectrum light. This unusual combination of physical properties is achieved by combining liquid crystalline self-organization of cellulose nanofibers with polysiloxane cross-linking and control of the nanoscale porosity to form hybrid organic-inorganic mesostructured aerogels. Potential applications of these inexpensive materials range from single pane window retrofitting to smart fabrics.

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