A Novel 3D-Lattice Model of Fibrillar Polymeric Material

C. BRAD BENNETT, JAMES KRUCZEK, D.A. RABSON, W. GARRETT MATTHEWS, SAGAR A. PANDIT, University of South Florida — To elucidate a possible mechanism for simple material properties of fibrillar polymeric bulk material containing cross-links between constituent components, we introduce a 3D-lattice model that depends on cross-link number density ($\rho$) and the ratio ($\chi$) of cross-link bond strength to thermal energy. The model predicts a phase transition in specific heat capacity occurring for $\chi$ between approximately 0.5 and 1.5, dependent on $\rho$. We present evidence that the properties of the represented phases are consistent with those of a solid phase and a liquid phase. These results indicate that variations in $\rho$ or $\chi$ alone may provide a convenient basis for Nature to provide a range of material properties with limited resources.

Christopher Bennett
University of South Florida

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