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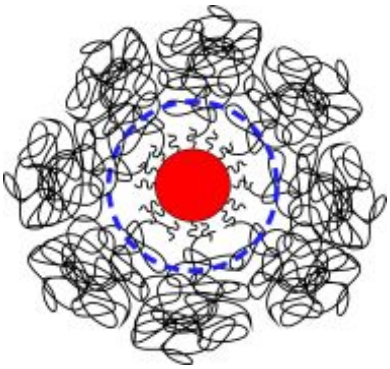
Graphic:



Nugget:

Ligand-modified nanoparticles in a polymer matrix significantly constrain the configuration of neighboring matrix chains when the enthalpic interactions are minimized. This mechanism impacts the development of critical physical properties for the overall composite. The glass transition temperature and elastic modulus are decreased, contrary to the conventional impact of rigid nanoparticles to a polymer matrix. Additionally, at less than 1% mechanical strain, enthalpically-neutral nanoparticles align to begin the alteration of failure processes in glassy polymer materials. This alignment, subsequent repulsion, and entrapment of nanoparticles near or in a polymer craze leads to enhanced ductility in the polymer film. Our fundamental insight into these materials aid the future design of nanocomposite materials related to advanced applications in fields such as opto-electronics