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Effects of nanoscale structure on the mechanical properties of nanoporous silica. DANIEL LACKS, Case Western Reserve University — Porosity in materials can create materials with superior function, by reducing the weight and dielectric constant of the material – e.g., in nature, porous bone has evolved to reduce the weight of the skeleton and thus minimize the energy required for animals to move. However, the introduction of porosity is not without a downside, as porosity generally compromises the mechanical behavior of a material, which could preclude its utility. We use molecular dynamics simulations, in conjunction with an experimental investigation, to show that nanoscale structuring can be used to make porous silica with mechanical properties that remain favorable as the porosotity increases. In particular, the elastic modulus scaling with density is much weaker in these materials than in conventional porous materials. Our simulations show that this scaling occurs because the nanoscale structure induces a change in the atomic level structure, where the new structure has a higher local stiffness. (Fan et al, Nature Materials 6, 418 (2007)).

Daniel Lacks
Case Western Reserve University

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