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First-principles studies of the structural and electronic properties of rigid carbon nanofoam

Sora Park[1], Kritsada Kittimanapun[2], Jeung-Sun Ahn[1], David Tománek[2], Young-Kyun Kwon[1,3]

[1]Department of Physics, Kyung Hee University,
[2]Department of Physics and Astronomy, Michigan State University,
[3]Research Institute for Basic Sciences, Kyung Hee University

Using *ab initio* density functional calculations, we investigate the structural and electronic properties of porous schwarzite structures formed by sp^2 carbon minimal surfaces with negative Gaussian curvature. We calculate the equilibrium geometries, elastic properties and electronic structure of two systems with cubic unit cells containing 152 and 200 carbon atoms, which are metallic and very rigid. The porous schwarzite structure can be efficiently doped by electron donors as well as accepors, making it a promising candidate for the next generation of alkali ion batteries. Furthermore, the schwarzite structures can be magnetic when doped and thus act as arrays of interconnected quantum spin dots. We also propose that two interpenetrating schwarzite structures be used as a ultimate super-capacitor.