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Evolution of Thermally Annealed Graphitic Amorphous Carbon toward Graphene: Structure, Vibrational Dynamics, Electron Emission and Band Gap JR DENNISON, JODIE GILLESPIE, Utah State University, STERLING SMITH, General Atomics — Standard structural models of graphitic amorphous carbon (g-C)—a ubiquitous form of disordered carbon present in the production of graphenes, nanotubes, fullerenes, diamond films, and graphite—postulate that g-C is composed primarily of sp^2-bonded nearly planar rafts with a structural distribution of carbon rings with 4 to 8 atoms. An embedded ring approach is used to model vibrational dynamics for planar disordered materials and determine the structural evolution of thermally annealed g-C, based on fits to Raman spectra of g-C annealed to temperatures ranging from 22 °C to 1050 °C. This vibrational model assumes that constituent atoms of a material are arranged in n-membered planar rings embedded in the effective medium, a continuous random network of atoms. From the relative intensities of the different frequency peaks resulting from in-plane normal modes, our procedures provide quantitative ring statistics for the structure of g-C. Unannealed g-C is found to have many 5- and 7-membered rings, but the fraction of 6-membered rings increases with annealing temperature consistent with the known result that g-C evolves to nanocrystalline graphite under high T annealing. The structural model is used to explain measurements of the band gap and electron emission of g-C as it is thermally annealed toward a graphene-like structure.

JR Dennison
Utah State University

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