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Thin Films of Glassy Carbon Prepared by Cluster Deposition

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Abstract : Glassy carbon exhibits excellent biological compatibility with live tissues meaning it has high potential for applications in life science. Moreover, glassy carbon has interesting properties including 'high temperature resistance', hardness, low density, low electrical resistance, low friction, and low thermal resistance. The structure of glassy carbon has long been a subject of debate. It is now admitted that glassy carbon is 100% sp2. This term is a little bit confusing as long sp2 hybridization defined from quantum chemistry is related to both properties: threefold configuration and pi bonding (parallel pz orbitals). Using plasma laser deposition of carbon clusters combined with pulsed nano/femto laser annealing, we are able to synthesize thin films of glassy carbon of good quality (probed by G band/ D disorder band ratio in Raman spectroscopy) without thermal post annealing. A careful inspecting of Raman signal, plasmon losses and structure performed by HRTEM (High Resolution Transmission Electron Microscopy) reveals that both properties (threefold and pi orbitals) cannot coexist together. The structure of the films is compared to models including schwarzites based from negatively curved surfaces at the opposite of onions or fullerene-like structures with positively curved surfaces. This study shows that a huge collection of porous carbon named vitreous carbon with different structures can coexist.

Keywords : glassy carbon, cluster deposition, coating, electronic structure
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