**Spectral and structural properties of unique low dimensional amorphous carbon structures**

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Amorphous carbon structure such as graphitic amorphous-carbon (a-C) and diamond like tetrahedral amorphous carbon (Ta-C) have already been widely investigated.[1, 2] These amorphous structures are derived from bulk carbon structures including graphite and diamond. While low dimensional carbon structures including graphene, fullerenes, nano-tubes have gained a lot of attention, low-dimensional amorphous carbon structures are on the other hand less well known.[3, 4]

Here we investigate the structure and spectroscopic characteristics of low dimensional amorphous carbon structures including amorphous carbon-spheres and amorphous carbon-tubes. Fig. 1(a) shows a transmission electron microscope (TEM) image of an amorphous carbon sphere. The structure of the amorphous carbon sphere is shown in greater details in Figure 1(b). The corresponding electron diffraction pattern is displayed in Fig. 1(c). Fig. 2(d) shows a TEM image of an amorphous carbon tube. The structure of the amorphous carbon sphere is also shown in greater details in Fig.1 (e).

The corresponding electron diffraction pattern from the amorphous tube is displayed in Fig. 1(c). Figures 2(a), (b) show the reduced density function (G(r)) for amorphous carbon spheres and tubes respectively calculated from the electron diffraction patterns.[5] The calculated radial distribution function (J(r)) is shown in Figs. 2(c) and (d) for amorphous carbon spheres and tubes respectively. In both cases the structures agree with amorphous low dimensional graphitic carbon. We also discuss the electron structure of these amorphous carbon structures using orientation dependent electron energy loss spectroscopy (EELS)

**References**

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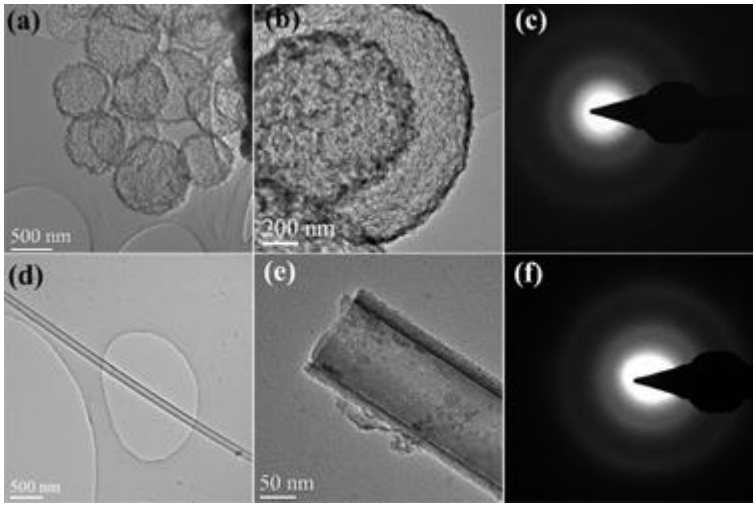


FIG. 1 (a) (b) Amorphous carbon spheres (c) electron diffraction pattern for the carbon sphere (d)-(e) Amorphous carbon tubes (f) electron diffraction pattern for the amorphous carbon tube

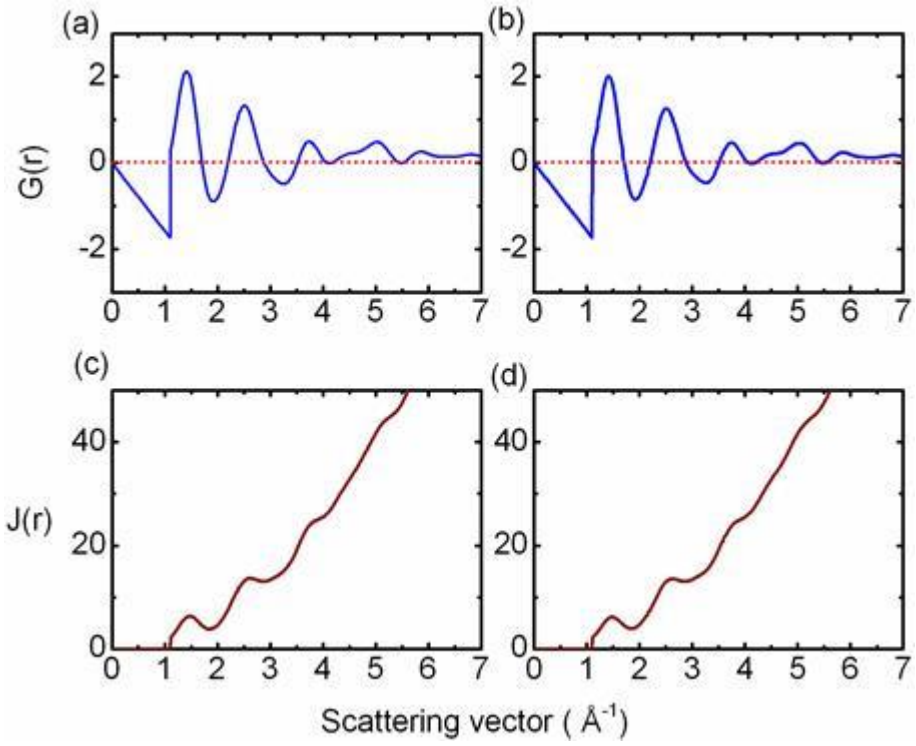


FIG. 2. Reduced density function (G(r)) for (a) amorphous carbon spheres (b) amorphous carbon tubes. Radial distribution function ((J(r)) for (c) amorphous carbon spheres (d) amorphous carbon tubes.