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Local structures of diamond-like carbon (DLC) films formed by various methods were studied by near-edge X-ray absorption fine-structure (NEXAFS) spectroscopy. The DLC films are characterized by the $sp^2/sp^3$ ratio, which influences the mechanical and electronic properties. NEXAFS spectroscopy is sensitive to the $sp^2/sp^3$ ratio, because the isolated peak corresponding to the 1$s$→$\pi^*$ resonance transition can be observed. Carbon K-edge NEXAFS spectra for DLC thin films, which were synthesized by various methods, were measured using the total electron yield mode in the range of 275 eV–320 eV. A peak due to the coupling of carbon with oxygen was observed in the spectra of some DLC films, whereas it was not observed in the spectra of hydrogenated carbon films formed by RF sputtering. The obtained relative $sp^2$ contents of the DLC films were distributed in the range of $\approx$20%. The minimum $sp^2/sp^3$ ratio was obtained from DLC films formed by vacuum arc deposition from graphite, and large $sp^2/sp^3$ ratios were obtained from DLC films formed by plasma chemical vapor deposition from hydrocarbons. The local structure of a DLC film was concluded to depend on the synthesis method, and in particular, the carbon source material.

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