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Colorful carbon nanopopcorns formed by plasma CVD of diamond-like carbon from CH4 and co-deposited C60 followed by reaction with water vapor TOSHIHIRO SHIMADA, WEI XIE, TAKUYA MIURA, TAKASHI YANASE, TARO NAGAHAMA, Faculty of Engineering, Hokkaido University — We report the synthesis of a new carbon material - diamond-like carbon (DLC) film co-deposited with 1 % C60 molecules - by plasma CVD. The synthesized films exhibited strong iridescence colors after being exposed to an atmosphere containing water vapor, whereas they were transparent just after the deposition. The refractive index of the iridescent films was as high as 3.6 at 650 nm. An electron microscopy examination revealed that the film expanded by more than twice while forming 10 - 100 nm sized grain-like structures after its exposure to water vapor. The reaction has been examined experimentally and theoretically: FTIR after exposure to D2O reveals that OH are connected with carbon. Raman spectra were only slightly different from transparent DLC without C60. Quantum chemical calculation revealed that the C60 conected with other carbons in DLC networks can react with water to make OH bonds. It is associated with cage-breaking of C60, which will initiate the deformation of DLC network. This work demonstrates a new concept of incorporating reaction centers in carbon solids by plasma CVD to make carbon-based nanostructures.

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