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Incorporation Effects of Nitrogen into Ultrananocrystalline Diamond/Hydrogenated Amorphous Carbon Composite Films by Physical Vapor Deposition TSUYOSHI YOSHITAKE, Kyushu University — Nitrogen-doped ultrananocrystalline diamond/hydrogenated amorphous carbon (UNCD/a-C:H) composite films were deposited in nitrogen and hydrogen mixed atmospheres by pulse laser deposition using a graphite target. The existence of UNCD crystallites in the film with a nitrogen content of 7.9 at.% was confirmed from the XRD measurement. The UNCD crystallite size was estimated to be 2 nm using Scherrer's equation. The value is smaller than that (5 nm) of undoped films. From the Fourier transform infrared (FTIR) and near-edge X-ray absorption fine structure (NEXAFS) spectra, it was found that the chemical bonding formation of nitrogen atoms with carbon atoms accompanies with an increase in the amount of sp^2-bond. The film possessed n-type conduction with an enhanced electrical conductivity of 18 $\Omega^{-1}cm^{-1}$ at 300 K. A heterojunction consisting of p-type Si and n-type nitrogen-doped UNCD/a-C:H composite exhibited a typical rectification action with a low leakage current. The result indicated that nitrogen atoms are chemically bonded in the UNCD/a-C:H composite film and they strongly influence both the structural and electrical properties.

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