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Gold nanoparticle formation in diamond-like carbon using two different methods: Gold ion implantation and co-deposition of gold and carbon

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ABSTRACT

We describe work in which gold nanoparticles were formed in diamond-like carbon (DLC), thereby generating a Au-DLC nanocomposite. A high-quality, hydrogen-free DLC thin film was formed by filtered vacuum arc plasma deposition, into which gold nanoparticles were introduced using two different methods. The first method was gold ion implantation into the DLC film at a number of decreasing ion energies, distributing the gold over a controllable depth range within the DLC. The second method was co-deposition of gold and carbon, using two separate vacuum arc plasma guns with suitably interleaved repetitive pulsing. Transmission electron microscope images show that the size of the gold nanoparticles obtained by ion implantation is 3–5 nm. For the Au-DLC composite obtained by co-deposition, there were two different nanoparticle sizes, most about 2 nm with some 6–7 nm. Raman spectroscopy indicates that the implanted sample contains a smaller fraction of sp^3 bonding for the DLC, demonstrating that some sp^3 bonds are destroyed by the gold implantation.

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