

Diamond-like Carbon Coatings with Precise and Localized Silver Doping for High-Performance Biomedical Applications

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Abstract: Diamond-like carbon (DLC) coatings are recognized due to superior mechanical [1], biomedical, and tribological [2] performance. Therefore, these coatings are actively being used for artificial orthopaedic joints, stents, heart valves, etc. applications. Silver is doped in DLC coatings to boost its biocompatibility for superior biological performance. The increasing amount of silver is inferred to deliver better biological performance. However, DLC coatings lose their unique mechanical and tribological characteristics, such as high hardness, low friction coefficient, and low wear rates due to silver-induced ductility in the coatings. In this work, silver doped DLC coatings are made with magnetron sputtering technique and the deposition process is controlled to dope silver in form of small isolated nanoparticles at defined depths. The coatings are characterized by microstructure, hardness and Young's modulus, and biocompatibility studies. The preliminary results suggest that the silver nanoparticles are ~ 10 nm in diameter and uniformly distributed in a plane and embedded at control depths. It is observed that ~ 2 at.% silver when doped in DLC with a controlled deposition process gives similar biocompatibility as delivered by ~ 17 at.% silver which was doped with conventional co-sputtering methods.

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References

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