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Adhesion Enhancement of DLC on CoCrMo Alloy by Diamond and Nitrogen Incorporation for Wear Resistant Applications.

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Abstract:

Diamond like carbon (DLC) coating is promising to increase the service lifetime of hip joints made of CoCrMo alloy. However, the weak adhesion of DLC on the alloy presents problems for this application. This work aims to improve the adhesion of DLC on CoCrMo alloy with nitrogen doping and diamond incorporation. Microcrystalline diamond particles were synthesized on CoCrMo alloy sheets by Microwave Plasma Enhanced Chemical Vapor Deposition and nitrogen doped DLC thin films were then deposited on them by Inductively Coupled Plasma assisted Chemical Vapor Deposition. The effect of nitrogen doping and diamond incorporation on the film adhesion was investigated by Rockwell C indentation. The results show that nitrogen doping and diamond incorporation can improve the film adhesion significantly. Ball-on-disc friction and wear testing results reveal that the friction coefficient and wear rate between polyethylene balls and DLC (doped with nitrogen) coated CoCrMo decreases with the increase of nitrogen content in the coatings. Those results have demonstrated that the modified DLC films are promising for total hip joint replacement application.

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