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The effects of Sp³ gradient structure on the adhesive strength of carbon coatings synthesized by ion-beam deposition methodSung-Min Kim¹, Sang-Sik Kim², Jung-Uk Shin², Seung-Chun Oh²¹Plasma Technol team/IAE, Yongin-si, South Korea ²Plasma Technol. team/IAE, Yongin-si, South Korea

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In this work, for the application of carbon coatings to diesel injector needle, the gradient carbon coatings consisting of graphite/nanocrystalline graphite/diamond-like carbon multilayered structure were synthesized onto Cr interlayer deposited on HSS (high speed steel) substrate using ion-beam deposition method. The structure of conventional carbon coatings and gradient carbon coatings was investigated by FE-SEM, AFM, Raman spectroscopy and XPS. Evaluation of mechanical property was made using residual stress test, nano-indentation and scratch test. The results show that the hardness of gradient carbon coating was approximately 24 GPa, which is lower than the hardness of the conventional DLC coatings but higher than that of the conventional graphite. However, the gradient carbon coating with excellent hardness was superior adhesion strength to conventional carbon coatings due to the relaxation of residual stress in initial graphite layer. The detailed experimental results will be presented.

Keywords

Carbon coating

sp³

ion beam deposition

adhesive strength