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Home

Start

Browse

Browse by Day

At-A-Glance

Author Index

General Information

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Excellent adhered thick DLC coatings on high-speed steel deposited by ion-beam-assisted plasma immersion ion implantation & deposition and high-power impulse magnetron sputtering pretreatment

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Diamond-like carbon (DLC) films have attracted much attention recently due to their excellent properties. Unfortunately, the poor adhesion caused by internal stress limits its thickness within 3~5 μm which can't bode well the critical applications such as aerospace and automobile where thick coatings are required. Most researchers study doping to obtain a thick DLC, however, the mechanical and corrosion resistance properties decrease obviously. HiPIMS could provide a high ion beam due to its high ionization rate, and have become a promising method to prepare an interlayer with good adhesion. In this work, doping-free DLC coatings with more than 10 μm thickness were fabricated on high-speed steel by Cr/CrC_x interface layers construction by HiPIMS and high energetically ion implantation and deposition assisted by anode layer ion source. The cross-sectional morphology, composition and structure were studied by SEM, Raman and XPS. The results show that the thickness of prepared DLC coating is 18-20 μm and the sp³/(sp²+sp³) ratio is about 60%. The adhesions are strongly depended on the interface layer structures and the best one is 73N. Besides, the friction and corrosion resistance were evaluated ball-on-disk friction and salt-spray corrosion. A durable low friction coefficient of 0.12 and excellent corrosion resistance were observed.

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