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Effect of pulsed arc discharge energy on properties of doped ta-C filmsIvailo Dolchinkov¹, Gerrit Jan van der Kolk²¹IHI Ionbond AG, Olten, Switzerland ²Ionbond Netherlands b.v., Venlo, Netherlands

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Hydrogenated Diamond Like Carbon (DLC) coatings are widely used as protective coatings in industry due to their high hardness, low friction and high wear resistance. However, their thermal stabilities at elevated temperature restrict many potential applications as high temperature lubricating coatings. Non-hydrogenated DLC is now in the focus of many industries due to its better temperature stability and higher hardness.

Extensive research has been done in the past whereby the effect of impact energy, angle of incidence, substrate temperature and deposition rate on properties of ta-C were studied. We have shown in earlier presentations that we can modulate the sp²-sp³ content in the film at nanoscale if the right conditions are chosen.

In the present paper we report about ta-C coatings prepared from pure and doped graphite targets by means of pulsed Arc evaporation. Two doping elements were chosen, Boron and Tungsten, with target dopant level varying between 0.5 and 8%. Majority of the work has been done on W doped, as W is clearly distinguishable from C in SEM and HRTEM.

The pulsed ARC discharge has been operated with a very steep rise rate of the ARC current, typical in 5 μ s the ARC current reaches maximum peak currents, upon which the pulse discharge is switched off. Plasma densities in the ARC discharge are clearly higher than e.g. with HIPIMS. Manipulating the applied pulsed arc discharge energy influences the impact of the impinging carbon ions with the substrate and periodically applied deposition conditions. We have checked how the film properties are affected. The results from the two doping model investigation tests are described in detail.

Keywords

DLC

protective coating

doped ta-C

arc discharge