[총회초청 4]

DEPOSITION OF CONTINOUS AND WELL ADHERING DIAMOND FILMS ON STEEL

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ABSTRACT

Deposition of well adhering and continous diamond films on steel is restrained by: (1) formation of soft black carbon at the substrate film interface; (2) rapid diffusion of carbon species into the substrate bulk and (3) poor adhesion strenght of the films to the substrate which results from both the formation of the soft carbon and incompatibility bewteen the thermal expansion coefficients of diamond and steel.

In this lecture we report a successful solution for diamond deposition onto steel. This was achived by reducing the mismatch in mechanical and physical properties of steel and diamond responsible for the adhesion problems of diamond films to steel by the production of a graded intermediate layer between the substrate and the deposited film. The intermediate layer is a Cr/Cr-N 10 micron thick film formed by electrochemical deposition of Cr followed by nitridation in ammonina flow. As a consequense of this interlayer, continous diamond films up to 3 micron thick without any delamination have been deposited using a hot filament system at a rate of 1 micron per hour at a substrate temperature of 800C.

The samples have been examined by Auger Electron Spectroscopy, X-Ray Diffraction, Raman and Scanning Electron Microscopy. The toughness of the diamond films was evaluated by measuring the minimum load necessary to induce delamination with a cone-shape diamond indenter. No delamination events occurred during indentation up to loads of 800N. It is suggested that Cr/Cr-N interlayers could be used for the industrial development of diamond films deposition on iron based alloys.