The dependence of the structure and mechanical properties of thin ta-C coatings deposited using electromagnetic venetian blind plasma filter on their thickness

V. Zavaleyev, J. Walkowicz, T. Kuznetsova, T. Zubar

PII: S0040-6090(17)30544-8
DOI: doi: 10.1016/j.tsf.2017.07.050
Reference: TSF 36116

To appear in: *Thin Solid Films*

Received date: 7 November 2016
Revised date: 14 July 2017
Accepted date: 19 July 2017

Please cite this article as: V. Zavaleyev, J. Walkowicz, T. Kuznetsova, T. Zubar , The dependence of the structure and mechanical properties of thin ta-C coatings deposited using electromagnetic venetian blind plasma filter on their thickness, *Thin Solid Films* (2017), doi: 10.1016/j.tsf.2017.07.050

The dependence of the structure and mechanical properties of thin ta-C coatings deposited using electromagnetic Venetian blind plasma filter on their thickness

V. Zavaleyev[a,1], J. Walkowicz[a], T. Kuznetsova[b], T. Zubar[b]

[a]*Faculty of Technology and Education, Koszalin University of Technology, ul. Sniadeckich 2, 75-453 Koszalin, Poland*

[b]*A. V. Luikov Heat and Mass Transfer Institute National Academy of Sciences of Belarus, 15 P. Brovki str., 220072 Minsk, Belarus*

Abstract

In this paper, we present the results of studies determining the optimum thickness of amorphous tetrahedral carbon (ta-C) thin films for industrial applications. ta-C coatings from 50 to 1000 nm thickness were synthesized by a pulsed vacuum-arc method using a water-cooled electromagnetic Venetian blind plasma filter. Systematic studies of the thickness dependence of the microstructure and mechanical properties showed that the content of sp^3 bonds in all the deposited coatings are equal (about 68%), but the 300 nm thick coatings exhibited the best mechanical properties (hardness H > 50 GPa, adhesion L_{c2} = 48 N). These coatings were deposited on industrial cutting taps with 2 and 2.5 mm diameters and tested in industrial conditions. The results of the threading tests performed with Inox stainless steel showed that the durability of the ta-C coated tools were significantly higher compared with the uncoated ones. These real-world industrial tests confirmed the usefulness of the electromagnetic Venetian blind plasma filter for synthesizing thin ta-C coatings with excellent physico-mechanical characteristics.

[1] Corresponding author:
tel: 48-605-324-844
E-mail address: viktor.zavaleyev@tu.koszalin.pl, zavaleev@list.ru