Accepted Manuscript

A critical review of diamond like carbon coating for wear resistance applications

Ankit Tyagi, R.S. Walia, Qasim Murtaza, Shailesh M. Pandey, Pawan K. Tyagi, Bharat Bajaj

PII: S0263-4368(18)30359-7
DOI: doi:10.1016/j.ijrmhm.2018.09.006
Reference: RMHM 4788

To appear in: *International Journal of Refractory Metals and Hard Materials*

Received date: 30 May 2018
Revised date: 22 August 2018
Accepted date: 3 September 2018

Please cite this article as: Ankit Tyagi, R.S. Walia, Qasim Murtaza, Shailesh M. Pandey, Pawan K. Tyagi, Bharat Bajaj , A critical review of diamond like carbon coating for wear resistance applications. Rmhm (2018), doi:10.1016/j.ijrmhm.2018.09.006

A critical review of Diamond like Carbon Coating for Wear Resistance Applications

Ankit Tyagi [a], R.S. Walia [a], Qasim Murtaza [a*], Shailesh M. Pandey [a], Pawan K Tyagi [b], Bharat Bajaj [b]

[a] Department of Mechanical Engineering, Delhi Technological University, Delhi 110042, India.

[b] Department of Applied Physics, Delhi Technological University, Delhi 110042, India.

Abstract

In recent years innovation in carbon based materials have encouraged both researchers as well as industrialists to develop materials/ composites with improved tribological properties. Researchers have been fascinated to develop diamond like carbon (DLC) or carbon nanotubes (CNTs) reinforced coatings to their good corrosion resistance, excellent wear resistance, good adhesion strength, and self -lubricious nature. The present review article is mainly focused on various techniques employed in order to process DLC/CNTs coatings as well as provide a summary of DLC/CNTs deposition on different substrates. The present study includes major types, properties and tribological behavior of carbon based materials and mechanisms involved in coating deposition. The study also discusses that deposition of DLC/CNTs coatings on the substrate materials enhances the wear, corrosion and mechanical properties of the substrate.

Keywords: Diamond like carbon (DLC); Carbon nanotubes (CNTs); Deposition mechanism; Wear mechanism.

1. Introduction

Over the years, many researchers and industrialists are becoming concerned about optimizing and enhancing tribological properties for potential surface engineering applications. Wear (tribological process) occurs when two surfaces are in contact and both/one are moving relative to each other. A tribology study reveals that even 15-20% reduction in wear/friction can significantly reduce economic costs in relation to environmental benefits [1]. There are several tribology systems that can impart an ultra-low friction coefficient, high wear resistance and high mechanical properties. Application of coatings is one of the most widely used route in order to tailor surface morphology, wear performance, adhesion and fatigue strength of substrate material without altering bulk properties of the substrate. The commonly employed tribology techniques for coating deposition, thermal spray deposition, physical vapor deposition/chemical vapor deposition (PVD/ CVD), ion beam deposition, radio frequency magnetron sputtering (RF-M.S.) and electro deposition (ED). Successful deposition of materials open up new opportunity as well as encourages researchers to adopt new coating materials, having excellent electrical, mechanical, thermal, frictional and wear properties. Presently researchers have been focusing on materials diamond-like carbon (DLC) [2-4, 5-18], carbon nanotubes (CNTs) [19-21], graphite-like carbon [9, 22-25] in order to fabricate coatings with excellent wear resistance, corrosion resistant, high thermal conductivity, and damping capacity. DLC and CNTs are carbon allotropes of sp^2 and sp^2 & sp^3 hybridizations respectively. Amorphous carbon coating have shown excellent adhesion and friction resistance with potential application towards forming lubricant free sheet metal process [26]. In recent years, numerous research have been done to enhance wear performance of carbon-based coating materials. Even though lots of techniques are available for investigating physical and mechanical performance of DLC/CNTs coatings but still no standard procedures is available for calculating tribological properties of coated materials. To test tribological behaviors of DLC/CNTs, tribometers are used under ambient pressure with appropriate temperature and relative humidity.

It has been

*Corresponding author.