

Influence of the mechanical properties in the adhesion of the diamond like carbon into the edge of the carbide drill.

W. Silva-1^{1,*,#}, P. Martins-2², N. Cruz-3³, A. França-4⁴, J. Carneiro-5⁴, V. Trava-Airoldi-6⁵

¹Instituto de Biotecnologia-Unesp e Faculdade de Ciências Agronômicas de Botucatu Departamento de Bioprocessos e Biotecnologia, Rua José Barbosa de Barros, nº 1780, Botucatu, SP, Brasil, 18610307.

²Manufacturing Engineering Powertrain, Fiat Chrysler Automobiles Latam, Betim, Brasil, 32530-490.

³Laboratório de Plasmas Tecnológicos, Universidade Estadual Paulista. Instituto de Ciência e Tecnologia, Sorocaba, Brasil, 18087-180.

⁴Departamento de Engenharia Mecânica, Pontifícia Católica Universidade de Minas Gerais, Belo Horizonte, Brasil, 30535901.

⁵Laboratório Associado de Sensores e Materiais, Instituto Nacional de Pesquisas Espaciais, São José dos Campos, Brasil, 12227010

Carbide tools are commonly used in the automobile industry like drills due its high hardness and toughness. Those characteristics are essential for durability and high performance during work operation as drilling ⁽¹⁾. However, for making it suitable to a great number of holes without lose reliability of dimension, it is necessary a coating for reducing the friction coefficient ⁽²⁾. This work aims to improve the adhesion of a coating known as Diamond Like Carbon (DLC). DLC has no crystal lattice as a diamond, although your carbon sp³ hybridized atom forms a high resistant coating ⁽³⁾. An investigation using scanning electron microscopy, optical profilometer and atomic force microscopy were used for showing the morphology of the film. Besides that, Raman Scattered Spectroscopy was used to characterize the graphitic degree of the carbon film ⁽⁴⁾. The film adhesion was performed based on the VDI 3198 standard norm test. Mechanical properties were measured by application of small loads (mN) during indentation tests and showed the influence of the Young modulus and the hardness of the film. Nanoindentation tests showed the response of the materials and may be explain the cause of film delamination effects in the tool edge. In the end, it was concluded that a reasonable quality of DLC deposited on carbide tool with high adhesion and homogeneity can be achieved however needs more improvement related to the edges of the substrates.

[1] W. Silva *et al.* Surface & Coatings **284**, (2015) 404.

[2] W. Silva *et al.* Diamond & Related Materials, **42**, (2014) 58.

[3] W. Silva *et al.* Surface & Coatings **205**, (2011) 3703.

[4] W. Silva *et al.* Materials Research **16(3)**, (2013) 603.