# Evaluation of a multilayer Cr/CrN with DLC as top coating obtained using PVD

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Carbon-based coatings can be deposited on different substrates such as the steels, which are used in machine elements. These coatings are hard and have a very low friction coefficient, this latter can provide an advantage to reduce energy consumption in machine components that operates under sliding conditions such as shafts on plain bearings. Moreover, these coatings are chemically inert, and they could be used in contact with corrosive and/or aggressive environments that compromise the integrity of the surfaces [1,2]. Multilayer coatings can combine different properties, such as a high enough bearing capacity for the the bottom film and a top coating with better tribological or chemical behavior [3].

In this work, a multilayer Cr/CrN plus DLC as top coating which was deposited by means of MS-PVD Plasma Enhanced Magnetron Sputtering on nitrided and non nitrided mild alloy steel AISI 4140 (DIN 42CrMo4) is analyzed. The microstructure of the coating was observed by OM and SEM, and further analyzed by XRD and Raman Spectroscopy. Friction and wear resistance were evaluated in pin on disk tests, which were performed using $Al_2O_3$ ball, 10 N load and 1000 m distance. The adhesion was assessed by Scratch Test and Rockwell indentation. The first layer of the coating is the anchor base layer of CrN and the top layer is chromium dopped hydrogenated amorphous carbon (a-C:H:Cr), which provided excellent tribological properties. The friction coefficient for the coating was about 0.1 that turned out to be 80% less than the untreated steel as shown in Figure 1, and its wear loss volume was reduced about nine times.

The plasma nitriding pretreatment improved the adhesion and the scratch resistance especially after the application of a high normal load in a dynamic regime [4].

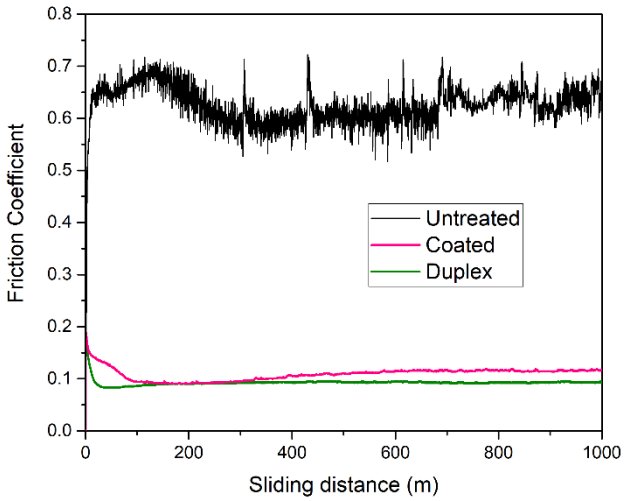


**Figure 1.** Friction coefficient of the samples under 10 N normal load using $Al_2O_3$ ball as counterpart.

**References**

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