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FRICTION COEFFICIENT, CHEMICAL CORROSION, AND WEAR OF DLCH FILMS IN ETHANOL AND GASOLINE.

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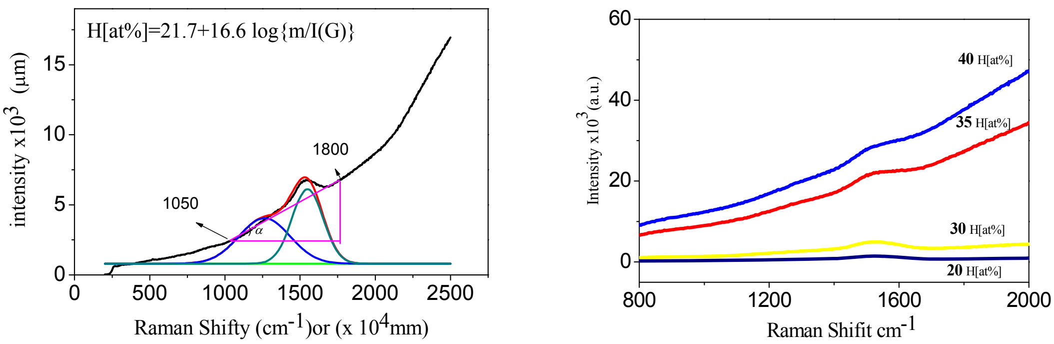
Abstract –This paper present the correlation between chemical corrosion, friction coefficient, and wear from DLC films with different hydrogen content in ethanol and gasoline. The goal was to analyze chemical interaction in terms of trybological behavior among DLCH films and two different regular fuels. Thus, electrochemical measurements, friction coefficient, wear, optical profiler images, and Raman spectra's were use to specify the correct hydrogenation in DLC films to work in contact with ethanol and gasoline.

The DLCH films were deposited up to 2 µm thickness on very polished iron based material substrates, using pure methane as a hydrocarbon source in chemical vapor deposition technique (PECVD) as described elsewhere[1]. Friction coefficient was analyzed using ball-on-plate trybometer, in reciprocating mode in ambient conditions; under 8N load and 8.0mm.s^{-1} sliding speed. The results were continually recorded for 150 cycles or 300 pass in 10mm displacement distance. The speed and load were chosen according to Radi paper[2]. Electrochemical measurements were carried out near stable condition in allowed area of 1.5 cm^2. The potential scans were performed from −1.5 V to 1.5 V at 1 mV/s rate. Electrochemical potentiometry plots were used to analyze chemical resistivity and total coatings porous for each DLC film immersed in ethanol and gasoline. Optical profiler images were used to analyze coatings topography. Finally Raman scattering spectroscopy from the DLC films surface, was used before and after chemical corrosion and friction coefficient measurements using argon ion laser (λ=514 nm) in backscattering geometry. The Raman spectra's were analyzed according to Casiraghi studies [3], that shown a near correlation between hydrogen concentration in the DLC films. It was observed that the photoluminescence background increase with H content.

Fig. 1(a) shows a plot with a Raman spectra and slope "m", was performed linear fitting regression from 1050 cm^{-1} up to1800cm^{-1} that was used to calculate the hydrogen content based on Casiraghi studies [3]. Fig. 1(b) shows spectra's from four DLCH samples, the PL increase with the H content, as expected after Robertson studies [4], due to the hydrogen saturation from nonradiative recombination centers. As the alcohol and gasoline are hydrocarbon structure with hydroxyl bonds, it can modify DLCH top surface with new recombination. The new surface can modify friction coefficient and wear and so, Raman scattering spectroscopy may be interesting technique to study differences features of DLCH samples before and after friction and wear measurements procedures.



(a) (b)

Figure 1: (1a)Raman spectra used to calculated the hydrogen content based in C. Casiraghi paper[3].(1b) Raman spectra with correlated H[at%] from DLCH films before alcohol and gasoline interaction.

References

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