MECHANICAL SPECTROSCOPY TO DETERMINE THE TORSION MODULUS (*G*) OF TEFLON

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1. Introduction

Teflon is widely used into applications for industry in general and in everyday life as coating on utensils, biomaterials, gears, graxetas, bearings, electrical insulators, screw seals, etc. They exhibit high thermal stability, low friction coefficient and chemical inertness [1]. By being subjected to mechanical efforts, it is important to know its mechanical properties as well as its shear modulus (*G*). In this work, it was constructed the system to study and measure *G* these materials. The aim of this work is to answer if this system could be used in the measurements of the polymers.

2. Experimental

An alternative method is presented to get *G* and which takes into account the rotational inertia of measured system and the study of anelastic relaxation [2]. In order to apply it and obtain *G* was necessary a rotational movement sensor (*RMS*) and the construction of a torsion pendulum as showed in Fig. 1. We chose four samples of Teflon in bar-shaped with uniform circular cross section, diameters D_1=(7.90±0.05) mm; D_2=(10.00±0.05) mm; D_3=(13.00±0.05) mm; D_4=(15.00±0.05) mm and length L=(49.80±0.05) mm. Based on the equation of motion of the torsion pendulum and material resistance[3], we get that $G = \frac{32L}{\pi D^4} I_{TOTAL}\omega_0^2(1-\frac{\delta^2}{4\pi^2})$ (1). I_{TOTAL} is the system' rotational inertia (I_{TOTAL}=(99.7±0.4)10^{-4}kgm^2; (212±1)10^{-4}kgm^2; (400±2)10^{-4}kgm^2 or (541±4)10^{-4}kgm^2) and its value were obtained according the literature [4]. The angular velocity ω_0 and the system' internal friction $\delta/2\pi$ are determinate dynamically, by means of angular position versus time curve. Fig. 2 shows the slopes (*B*) of the linear fit to the experimental points and through them you can verify that the relationship between *B*s is the same between the inertia of the system, I_{TOTAL}.

3. Results and Discussions

The values found for deviations of relations between the system inertias (I_{TOTAL}) and slopes (*B*) from the linear fit (Fig. 2) show a variation between + 8.1% to -7.9%. Thus, it was observed that this method can be applied in this case, since the results are obtained by two independent methods each other. This last fact validates the equation (1).

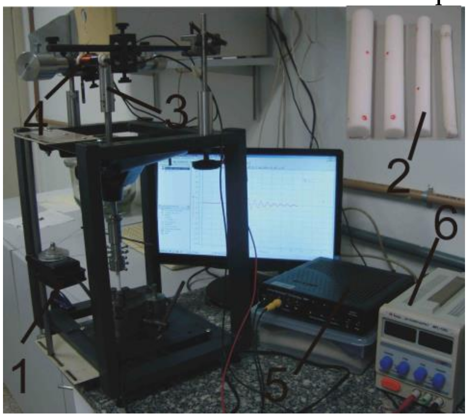

Fig. 1. *Set up: (1) RMS; (2) Samples of Teflon; (3)Torsion pendulum; (4) Electromagnet; (5) Interface PASCO 750; (6) Power DC.*

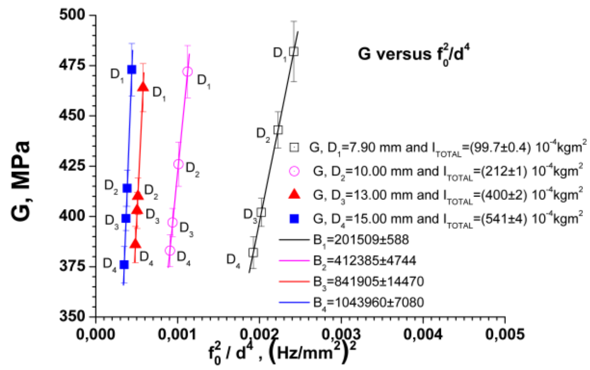

Fig. 2. *Result of the samples of Teflon with four different diameters and fixed L to validate G calculation equation.*

4. References

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