SYSTEM TO MEASURE THE SHEAR MODULUS (*G*) OF POLYPROPYLENE

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1. Introduction

Polypropylene (PP) is widely used in the automotive industry because presents great resistance against fracture and flexural fatigue, a good balance of thermal, chemical and electrical properties, and the increasing replacement of metal parts [1]. For the fact they carry out a structural function, PP is subject to mechanical efforts and it is important to know its shear modulus (*G*). In this work, it was constructed a system to study and measure *G* of these materials, with the aim of respond if additions for coloring these materials may affect the *G* values when compared to natural polypropylene.

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 three samples of polypropylene in bar-shaped with uniform circular cross section, diameter D=(10.20±0.05) mm and lenght *L*=(50.00±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}=(100.2±0.7)10^{-4}kgm^2; (211±2)10^{-4}kgm^2 or (414±6)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.

3. Results and Discussions

The values found are *G*=(845±21) MPa and *G*=(685±17) MPa, natural and grey or black color polypropylene, respectively. Thus, it was observed that the additives used for coloring polypropylene are able to alter their mechanical properties, in particular the value of *G*.

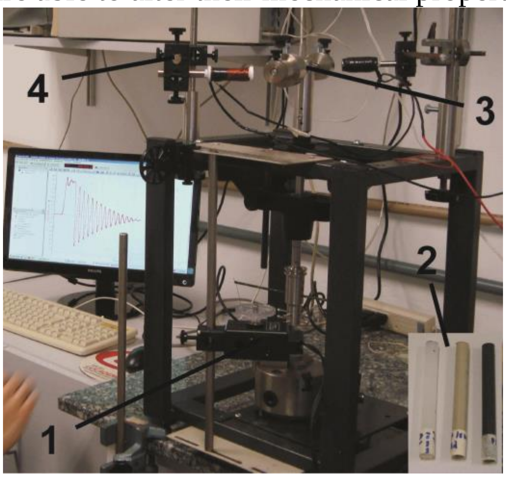

Fig. 1. *Set up: (1) RMS; (2) Samples of polypropylene; (3)Torsion pendulum (4) Electromagnet.*

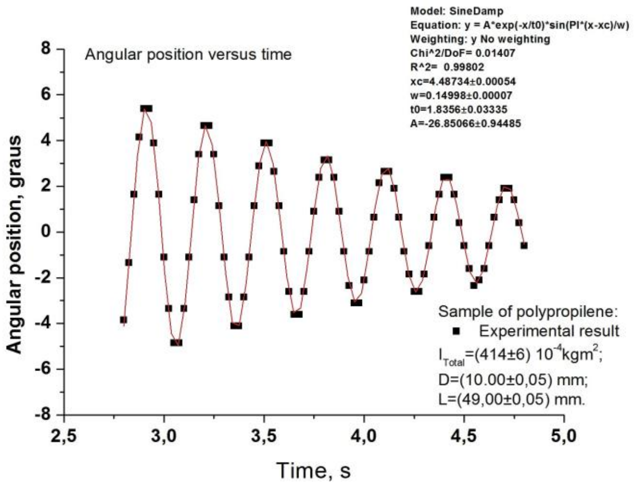

Fig. 2. *Typical result of samples of polypropylene using the RMS and Origin 7.0 applicative to fit a function "Wave form" and to get δ e ω_0.*

4. References

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