EXPERIMENTAL STUDY OF THE TRIBOLOGICAL BEHAVIOR OF A PIN - DISC TYPE OF CONTACT

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ABSTRACT

The present work is a contribution to the study of the complex phenomenon of wear in a contact pin-disc in dry sliding friction of two material couples (bronze - steel and unsaturated polyester virgin and charged with powder of graphite - steel). It consists of the determination of the friction coefficient, the study of the influence of the tribological parameters on this coefficient and the determination of the mass loss and the wear rate of the pin. This study is also widened to the highlighting of the influence of the graphite powder addition on the tribological properties of the polymer constituting the pin.

Keywords: Friction coefficient, mass loss, wears rate, steel, bronze, polyester, graphite.

INTRODUCTION

The wear is one of the major causes of the materials degradation and losses of mechanical performances of the equipments. It has a direct impact on the reliability and the longevity of the mechanisms. Wear by sliding depends on several tribological parameters which are interdependent such as the normal load (F_n), the sliding speed (V), the material hardness (H_v), etc. The aim of this work is to contribute to the study of the complex phenomenon of wear in a contact pin-disc in dry sliding friction of two material couples. It is realized according to the standards adopted by the tribological congress DIN 50321 and DIN EN 50324 for the representative parameters of a test [1]. The discs are of the XC48 steel. Vickers hardness of their surfaces is Hv 224 for the annealed state, Hv 338 for the quenched and tempered at 500°C state and Hv 524 for the quenched and tempered at 250°C state. The bronze pins are machined in bars of square section 6x6 mm\(^2\). Their Vickers hardness is Hv 270. Pins in polyester are realized by cutting and milling plates molded in virgin polyester and polyester charged with various mass percentages of a commercial graphite powder (%G) which does not have undergoes any chemical treatment (0%G, 1%G and 2%G).

The experiments were carried out on a tribometer of pin-disc type which we designed and realized. It is equipped with a strain gauge sensor allowing simultaneous measurement and without interference of the normal and tangential efforts during the test of wear [2].

RESULTS AND CONCLUSIONS

The main obtained results are summarized below. The increase of the normal load and the sliding speed causes the growth of the friction coefficient (f) whereas the increase of the percentage of graphite and the surfaces hardness contributes to its reduction (Fig. 1 and 2).
The mass loss also increases with the normal effort. The influence of the normal effort on the friction coefficient is more significant than that of the sliding speed. For the low values of the speed, the increase of the normal load involves an increase of the friction coefficient for the 3 states of hardness, while for high speed the increase of the normal effort and the hardness of the surface of the disc almost has no influence on the friction coefficient. The effect of the sliding speed diminishes to large values of the speed.

The increase of the amount of graphite powder leads to a decrease of the friction coefficient, the mass loss and the wear rate (Fig. 3 and 4). Indeed, a review of records of the mass loss and friction coefficients for the three compositions studied reveals that the lowest mass loss and the lowest coefficient of friction are given by the composition UP2 % G for the three normal loads considered. The graphite addition to the UP resin is beneficial; it plays the role of solid lubricant hence its contribution to the decrease in mass loss by reducing the coefficient of friction. These last results agree reasonably well with those found in the literature [3, 4, 5, 6 and 7].

REFERENCES