

EFFECT OF TEMPERATURE AND LOAD ON THE BEHAVIOR OF ADHESIVE WEAR ON THE TIRE-CONCRETE PAVEMENT INTERACTION

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ABSTRACT

Adhesion is the phenomenon present on the tire interactions and has been studied by different approaches. The adhesive wear in the experiments was tested by means of a tire wear simulator composed of a rolling system with a concrete pavement counter-face and a tire with the capacity to apply different loads.

According to the results at higher load, greater wear and particle detachment was observed. SEM microscopy and FTIR techniques were used to characterize tire wear particles. The aim of this paper is to analyze the effect of the temperature and load as variables on the tire-concrete pavement interaction.

Contact and adhesion; experiments in tribology; wear; adhesive wear

INTRODUCTION

Tire-pavement interactions have been studied by different approaches due to the high-level pollutant emissions. Non-exhaust particle emission account 21 % of road-traffic pollutant emissions [1].

Contact surface between tire-concrete pavement promotes molecular bonds that produces a temporally adhesion. Constant cycles of loading and unloading caused by the traffic provides the energy required to disassociate the molecular bonds.

At rolling tire on concrete pavement, the roughness of the concrete produces rubber particle detachment, which may vary depending on the environmental temperature. Furthermore, elevated temperatures generate stresses on concrete, causing cracks [2].

EXPERIMENTAL

Temperature changes on contact was monitored using a thermal camera. Also, a British Pendulum Skid Tester brand Wessex was used for measuring the friction on concrete pavement samples according to the ISO10545 -17 Standard.

The adhesive wear was tested with tire wear simulator designed and constructed in CUCSUR-UDG consisting of a rolling system with a drum (counter-face), tire testing, load control reaching a capacity of 78 KN. Concrete pavement sample was pouring to the drum. Wear tests were conducted at

three temperatures 0 °C, room temperature and 70 °C. And three loads as follows 2500 N, 3000 N and, 3500 N. To collect the detached particles, an enclosed chamber was used. Particle emissions resulting from wear were collected and weighed to analyze the tire mass loss.

RESULTS

With the increment of temperature into the chamber a decrease in the coefficient of friction was observed. Tire rubber expands due to the increment of the temperature. At a load of 3500 N tire wear was higher. Likewise, higher loads generate more detachment of Styrene-butadiene rubber particles with an average size of 80 µm. These particles have irregular geometry, roughness surface and present cluster formations (See fig. 1).

Finally, at 75 °C the coefficient of friction shows two times increment versus room temperature. Coefficient of friction showed a light decrease at 0 °C.

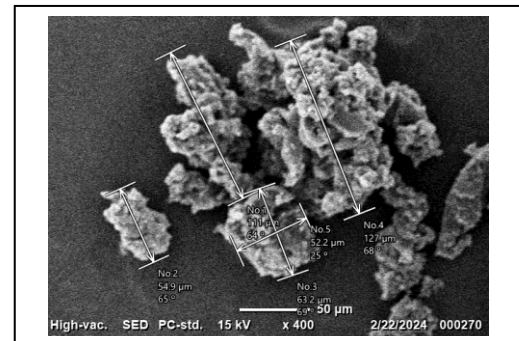


Fig.1 Micrography of styrene-butadiene rubber particle detached from a tire.

REFERENCES

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