EFFECT OF MICROSTRUCTURAL CHANGES ON TRIBOLOGICAL MECHANISMS IN AUTOMOTIVE FRICTION BRAKING CONDITIONS

Mathis BRIATTE[a*], Alexandre MEGE-REVIL[a], Yannick DESPLANQUES [a], Pierre-Olivier SANTACREU[b]
*mathis.briatte@centralelille.fr
[a] *Univ. Lille, CNRS, Centrale Lille, UMR 9013 - LaMcube - Laboratoire de Mécanique, Multiphysique, Multi-échelle, F-59000 Lille, France*
[b] *APERAM Stainless Steel, Research Center, BP15, 62330 Isbergues, France*

KEYWORDS

Experiments in tribology; Tribofilms and 3rd bodies; Wear; Disc materials.

ABSTRACT

During braking, energy dissipation leads to thermomechanical localizations in the form of hot bands or hot spots [1] where contact intensifies. High local stress leads to changes in the near-surface microstructure of the friction materials, which can influence tribological behavior [2,3].

In the context of automotive braking, this study focuses on the microstructural evolution of brake disc. 3 materials are investigated, a lamellar graphite cast iron and 2 martensitic stainless steels with initial microstructures and hardness differentiated by heat treatment. They are combined with an organic composite brake pad material. A specific experimental protocol was developed and implemented on a tribometer dedicated to braking tests, aimed at reproducing urban braking. Tests will be characterized in terms of friction stability, wear using profile measurements of rubbed surfaces, particle emissions with particle sizer spectrometers and an impactor for post-mortem composition analyses.

Particle emissions are used as indicators of the material flows involved in the tribological circuit, in line with disc and pad wear and the morphology of rubbed surfaces. The results show that the wear of the tribological pair is much lower in the case of stainless steels. Their use enables a fairly stable tribological circuit, despite the limited but sufficient quantity of third body. The disc microstructural evolutions are assessed from areas of high thermomechanical stresses. TEM analyses reveal relations between changes in the metallurgical state of the near-surface microstructures and tribological mechanisms. Finally, a key factor of the good tribological behavior of the steel disc v.s organic pad pairing is the amount of third body supplied by the pad.

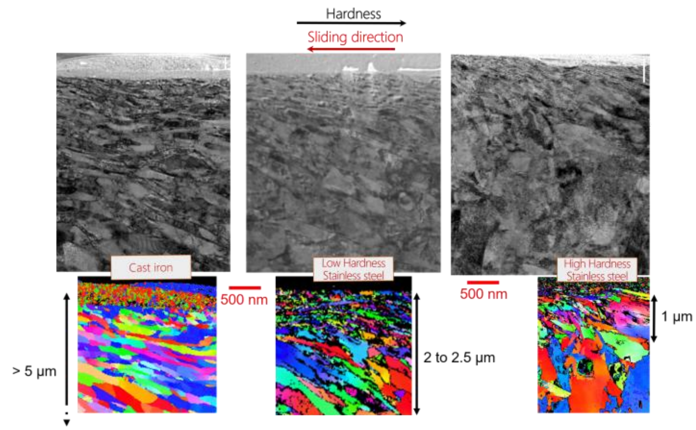

Fig.1: Depth affected by plastic deformation and crystalline orientation below the disc friction track. Cases of cast iron, Low Hardness and High Hardness stainless steel (STEM and NBD).

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