Friction Coefficient and Lubricant Film Thickness Determination under Different Sliding-Rolling Conditions Influenced by Surface Porosity in Sintered Material

Keywords: Porosity; Surface pores; Sliding-rolling; Powder metallurgy; Tribology

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INTRODUCTION

The effect of surface features has been widely explored in the context of Laser Surface Texturing (LST). The results found in literature show that surface texture can potentially reduce friction [1]; however, the use of a tightly controlled high frequency laser implies additional costs and may affect surface integrity. The use of controlled porosity and densification in sintered materials could be a valuable low-cost alternative to obtain surface features that could also improve surface performance in lubricated conditions. For these reasons, this work explores the possibility to exploit an alternative manufacture technique that may provide superior tribological performances with reduced manufacturing costs.

ABSTRACT

Surface pores effect on frictional behavior of lubricated point contacts was scrutinized under different entrainment speed and slide-to-roll ratios (SRR). The lubricant film thickness has also been measured through a specific interferometry technique designed for rough samples [2]. The experimental methodology comprised the manufacturing of samples by powder metallurgy, both balls and discs, which were tested separately against non-porous samples (NP - reference material). Sintering parameters were varied to obtain different surface features. Main results showed that the decrease of porosity led to friction reduction. Furthermore, surfaces with reduced dimensions pores (sintered at 800 ºC) improved tribological performance compared to NP material in harsh conditions (SRR 120%) and in similar specific film thickness range (*see Figure 1*).

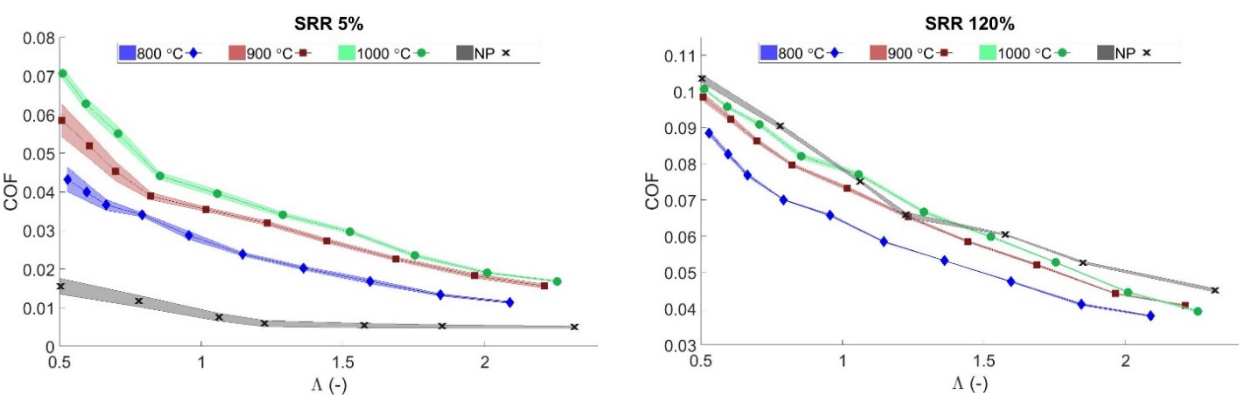

Figure 1 – COF x measured specific film thickness (Λ) for non-porous (NP-reference material) and porous (sintered balls) using SRR 5% and 120%. 800, 900 and 1000 ºC are the sintering temperatures. The volume fraction of porous decreased with the increase of temperature.

The study has contributed to evaluating and understanding how random micro-irregularities (surface features) could change lubricated conditions. This work will also support the exploration of the use of sintering in large-scale manufacturing processes, aimed at reducing production costs, which will be beneficial to the economy.

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