

## EFFECT OF POROSITY ON SURFACE DEFORMATION AND SUBSURFACE LAYER PRODUCED BY SCRATCH TESTS OF SINTERED LOW-ALLOY STEEL

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### KEYWORDS

*Friction; Contact and adhesion; Wear, Porosity.*

### ABSTRACT

Scratch tests were carried out on sintered steel samples to analyze the effect of porosity on surface deformation and hardening of the subsurface. Fe-Mo-C steel samples were manufactured using the spark plasma sintering (SPS) technique. Specimens with different levels of porosity were obtained due to sintering at temperatures between 850 °C (high porosity) and 1000 °C (low porosity) under vacuum conditions. Scratch tests were conducted with a Vickers pyramidal tip indenter at constant normal loads of 5 N, 10 N, and 20 N. After the scratch tests, the width and depth of the scratches were analyzed by 3D profilometry, the surface microstructure by scanning electron microscopy (SEM), and the subsurface grain deformation using electron backscatter diffraction (EBSD). The results showed that the samples with low porosity showed less material removed and a shallower tribological transformed layer with greater plastic deformation or dislocation density. On the contrary, in samples with high porosity, the strain energy is spent closing the pores and producing thicker layers with heterogeneous deformation. The friction coefficient presented a trend of increase with the increase in normal load, especially for low porosity samples, due to a greater accumulation of material that opposes the displacement of the indenter.

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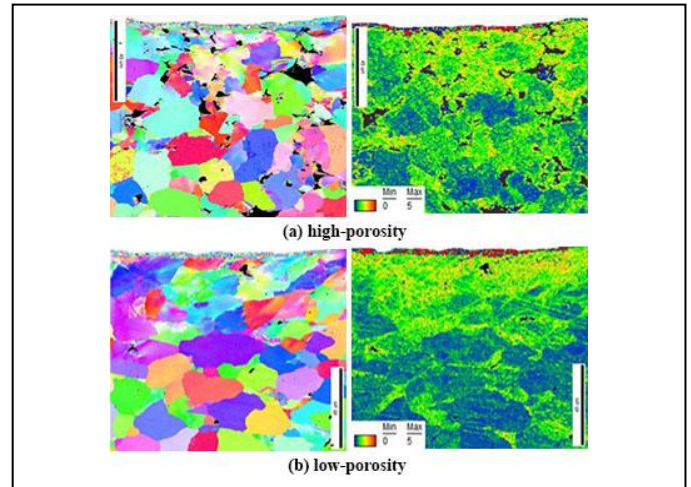


Fig.1 IPF and KAM maps of the cross-section of scratch tests using a normal load of 5N for steel sintered at different temperatures (a) 850 °C and (b) 1000 °C

Table 1 Scratch parameters from the cross-section profiles after tests at different normal loads.

Normal load (N)	Sintering temperature (°C)	Scratch área (Ss) (µm <sup>2</sup> )	Pile-up área (Sp) (µm <sup>2</sup> )	Worn material (Ss-Sp)	Pile-up ratio (Sp/Ss)
5	850	608.90	91.19	517.71	0.15
	1000	209.10	169.70	39.4	0.81
10	850	1173.00	113.80	1059.2	0.10
	1000	674.60	428.00	246.6	0.63

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