INFLUENCE OF THE SINTERING PROCESS ON THE SLURRY EROSION BEHAVIOR OF NEW FE-SIC CERMETS.

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KEYWORDS

Wear; Experiments in tribology; surface topography; cermets

ABSTRACT

WC-Co cemented carbides are widely used in severe wear conditions such as metal or rock cutting of abrasion and erosion resistant coatings. Nevertheless, there is a continuous drive to replace these materials due to their high cost and carcinogenic potential of Co[1]. In this work, new Fe-SiC cermets were developed for slurry transport applications such as pumps and hydrocyclones used on the mining industry.

For consolidating the specimens, the press and sinter, hotpressing and SPS techniques were used in order to compare the effect of the process parameters on the wear resistance of the materials. 50 wt.%SiC cermets were prepared by mixing 100 μm SiC powders (Nanografi) and 10 μm Fe powder (Höganás) using a tridimensional mixing and the consolidating the samples according to the processing conditions listed in table 1.

Table 1 Sintering conditions for Fe-SiC cermets

Press and Sinter	Compaction pressure: 600 MPa Sintering temperature: 1100 °C Sintering time: 1, 3 and 6 hours
Hotpressing	Sintering pressure: 50 MPa Sintering temperature: 1100 °C Sintering time: 30 min.
SPS (DC).	Sintering pressure: 50 MPa Sintering temperature: 1100 °C Sintering time: 5 min

A custom pot slurry test was used in order to characterize the tribological behavior the sintered cermets. The wear tests were performed for 10 hours, using a 50 wt.% solids alumina slurry and a rotating speed of 670 RPM. Results show that graphite precipitation (blue arrow in figure 1) away from SiC particles (red arrow) due to SiC dissociation [2] in the press and sinter samples negatively affects the wear resistance of these materials so press and sinter samples had an order of magnitude higher wear rates than both hot-pressed and SPS samples. Samples produced by SPS show both the highest densification (close to 98%) versus hotpressing (90%) and press and sinter (80%) which was also correlated to the wear resistance of the material. The main wear mechanism for both press and sinter and hot-pressed samples is detachment of SiC particles while SPS samples undergo ploughing of the metallic phase and chipping of the carbides. In all cases, porosity act as sinks for alumina particles which end up mitigating wear.

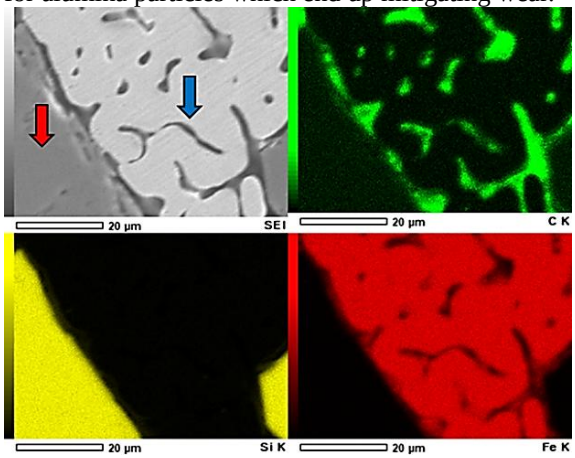

Fig.1 SEM-EDS showing the graphite precipitation in Fe-SiC cermets produced by press and sinter.

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