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# Correlation between abrasive wear and microstructure of zirconia and alumina

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**Abstract** – Monoliths of alumina and zirconia (partially and totally stabilized with yttria) were produced by different manufacturing techniques and sintering parameters. Microhardnesss and abrasive wear measurements were used to correlate the mechanical properties of the samples to the manufacturing technique and sintering parameters.

Advanced ceramics have superior mechanical properties compared to metallic materials, specially for applications were abrasive wear is relevant. The control of the several steps required for the fabrication of advanced ceramics´ monoliths is the key feature for profiting the superior properties and high performance of advanced ceramics.

The aim of this work was to produce monoliths of alumina and zirconia following distinct methods of manufacturing and sintering parameters, and to correlate the abrasive wear of each sample to its microstructure evaluated by scanning electron microscopy and density measurements. The manufacturing techniques used in this work were: low pressure injection molding (Pelstman MIGL 33), slip casting and uniaxial compression. Different parameters of pre-sintering and sintering were investigated. The density of the samples was measured by Archimedes method. Microhardness measurements were done with a Vickers indenter with a load of 100 g during 15 s. The abrasive wear of each sample was evaluated by the crater test, where a small sphere made of steel rotates in contact with the surface of the sample pressed by an applied force, with a SiC slurry flowing in-between them. The force applied to the sphere is known and the abrasive wear is evaluated by the dimension of the crater induced at the surface. In addition, pin-on-disc tests were done using a Plint and Partners tribometer, model TE 79.

Figure 1 shows the scanning electron micrography of an Al2O3 monolith produced by slip casting technique with grain size in the range of 1-10 µm and no intergranular porous. Figure 2 compares the hardness of the samples produced by different manufacturing techniques and sintering parameters. Figure 3 shows the wear coefficient values for alumina produced by different manufacturing techniques and the same sintering parameters. The abrasive wear of alumina and zirconia is very low and depends on the manufacturing technique employed to produce the monolith.

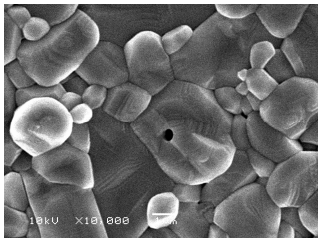

**Figure 1:** SEM image of a Al2O3 sample with no intergranular porous.

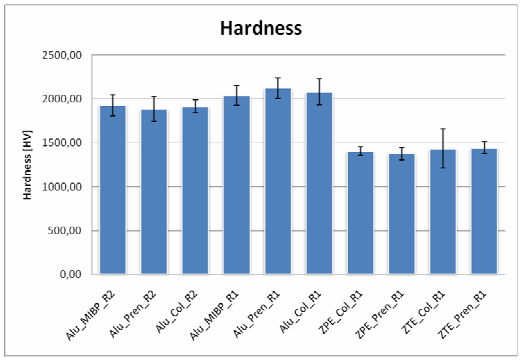


**Figure 2:** Hardness values of Al2O3 and ZrO2 samples produced by different manufacturing techniques.

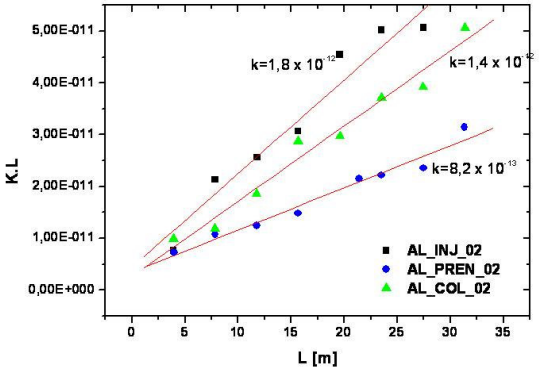


**Figure 3:** Abrasive wear coefficient values of Al2O3 samples produced by different manufacturing techniques.