Vitreous Carbon graphite alloys for tribological applications

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Vitreous carbon and graphite present sp2 hybridized structure. Graphite is a solid lubrificant. Compared to graphite, vitreous carbon presents lower crystallographic order and density, and higher chemical inertia. In this study, powder technology was employed to obtain alloys from those two materials. Monolithic vitreous carbon samples were milled with low and high energy mill to obtain micrometric particles of vitreous carbon. Then, the obtained milled powder was sieved to select the smallest micrometric particles. High quality graphite powder was mixed to the vitreous carbon powder, with graphite fraction of 0%, 15%, 30% and 50%. Poly furfuryl alcohol – a precursor used to obtain vitreous carbon - was added to the powder mixture to increase the adhesion of the carbonaceous particles. After pressing the powder mixture in a uniaxial press, the obtained samples were carbonized up to 1050 C in nitrogen atmosphere. During this process, the furfuryl alcohol was transformed into vitreous carbon, after losing volatiles. Vitreous carbon – Graphite samples were then polished. Powder size distribution was investigated with laser diffraction technique. The graphite particles presented average size of 13,8 µm. Vitreous carbon particles varied from 3,6 to 11,6 µm, depending on the milling time. Friction coefficient was measured with a pin-on-disk system using alumina sphere and varied from 0,087 to 0,18 depending on the composition and on the time of milling. Specific wear amount increased with graphite content. Surface roughness increased from 0,8 to 4,8 µm by increasing the graphite percentage. Scanning electron microscopy images and EDS of the samples will be shown. Interestingly, some samples presented unintentional iron presence in their composition due to the milling process. The metal did not increase the friction coefficient. Ferromagnetic particles could add magnetic properties to the carbonaceous samples, that could be used in the design of low friction moving parts.