POROUS RE-CARBONIZED VITREOUS CARBON AS THERMAL INSULATING MATERIAL

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1. Introduction

Vitreous carbon is a ceramic material employed in applications requiring rigidity and low specific mass, for example, as in substrate for the aerospace embedded mirrors. It is obtained by slow carbonization of thermoset polymers, such as furfuryl alcohol resin, at 1,000 °C, in an inert atmosphere. The vitreous carbon can be in monolithic form, MVC, or reticulate, RVC (Fig 1). Recently, the re-carbonized vitreous carbon, R-VC, has been developed through grinding, pressing and re-carbonization of the MVC. Thermal insulation of turbines for space reactors is a possible new application for the R-VC, requiring increased porosity throughout the material.

2. Experimental

In this work, the furfuryl alcohol resin was synthesized in a chemical reactor, catalyzed and carbonized. The vitreous carbon has been processed to obtain the R-VC. To reduce density by increasing the porosity an organic agent was added to the process (cassava flour). R-VC samples were developed with additions of 30 % and 60 % weight of cassava flour (Fig 2). Samples without flour, MVC and RVC were also produced. The Archimedes method was employed to measure the samples apparent specific mass and porosity. The capacity of the thermal insulating was estimated by measuring the temperature difference between the sample interfaces, with reference to the turbine operating temperature, about 150 °C, using a hot plate and an induction furnace [1].

3. Results and Discussions

The MVC showed a conduction material behavior. O RVC presented higher thermal insulation efficiency, although it exhibits high fragility. The addition of 30 % cassava flour was not adequate, while the 60 % addition contributed to specific mass reduction by 30 % and increased 56 % the open porosity. These porosity values indicate an increase in the estimate thermal insulating capacity of the R-VC, 42 % using the hot plate and 7 % using the induction furnace, showing that the addition of organic agents can be a feasible alternative to improve thermal and physical characteristics of the re-carbonized vitreous carbon.

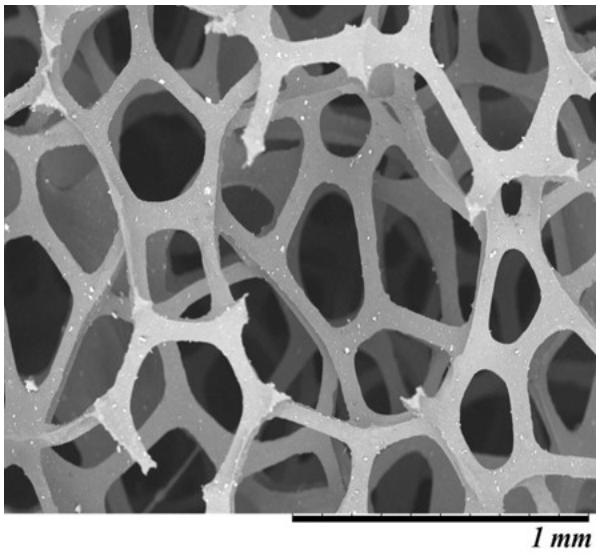

Fig. 1. *Reticulated Vitreous Carbon showing a porous structure.*

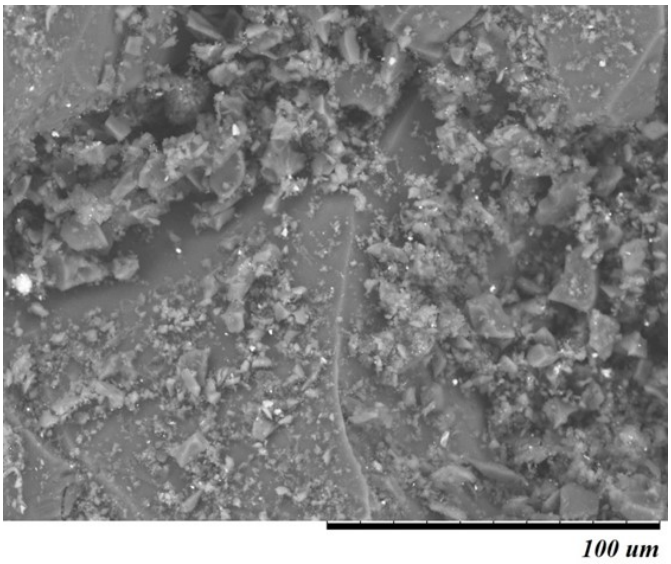

Fig. 2. *Porous Re-carbonized Vitreous Carbon having 60% of organic material*

4. References

[1]- F. Nascimento, MSc Dissertation, ITA, July 2016.

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