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Soda-Lime Glasses from Residues of Ornamental Rocks

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Abstract – In this work it was developed and characterized soda-lime glasses obtained from residues of silicate and carbonate ornamental rocks. The overall vitrified compositions revealed greened color due to the iron oxide content into the rock residues. The glasses were characterized by measuring their properties and then compared with those of commercial glasses aiming their industrial applications. The obtained results showed that the referred residues can be used as raw materials in the glass manufacture for industrial uses.

The production and the consumption of ornamental rocks became expressively and increasingly relevant in Brazil since it has been throughout the last years positioned among the ornamental rocks great producers worldwide. The importance of this sector for the economy is unquestionable, but along with the rocks beneficiation there has been significant losses of rocks as debris causing the generation of residues. These residues have not been properly used since they used to be discharged in an inadequate way in nature, contributing to the environment pollution without any planned utilization [1].

In this work glasses were obtained from the combination of three mixtures involving silicate rock residues, sand, and carbonates (source of calcium and sodium oxides). The same combination was also used for obtaining glasses now employing silicate and carbonate based rock residues.

The obtained glasses and the commercial ones were characterized for densities using the Archimedes method, for their structures by performing optical microscopy observations, for crystalline phases by means of X ray analyses (XRD), Vickers hardness, thermal analysis, ultraviolet spectroscopy in visible (UV/VIS) and the hydrolytic resistance from ISO 719.

The obtained glasses exhibited greened color, as shown in Figure 1. The XRD analyses revealed completely amorphous profiles (Figure 2). The measured densities and the hardness of the prepared glasses for the studied compositions, showed good similarity with those observed in the commercial glasses and the classification of the glasses according to their hydrolytic resistance varied with the amount of carbonates incorporated in the mixture, showing greater resistance for glasses with lesser oxide contents (Table 1).

Therefore, the economic utilization of such residues is potentially great by means of a simple adjustment in their compositions accomplishing the manufacture of the soda-lime glasses.

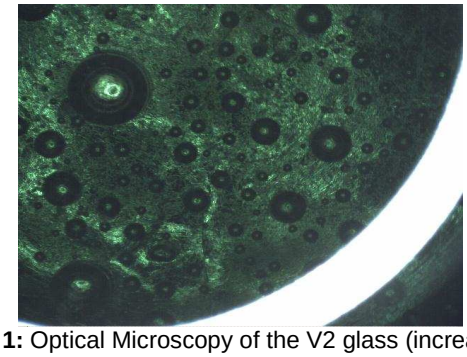

Figure 1: Optical Microscopy of the V2 glass (increase: 7X).

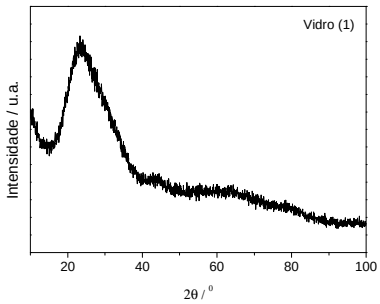

Figure 2: XDR analyses of the V1 glass .

Table 1: Resulted of analyses.

Glasses	Density (g/cm^3)	Hardness (GPa)	Transmittance (%)	Hydrolitic Resistance
V 1	2,47	4,8	41.6	HGB 2
V 2	2.53	4,8	47	HGB 3
V 3	2,53	4,8	45	HGB 5
V 4	3,24	4.8	33	HGB 3
VCE	2,39	4,7	63,7	HGB 4
VCJ	2,47	4,9	70	HGB 4

[1] Calmon, J. L.; Silva, S. A. C. Mármore e Granito no Espírito Santo: problemas ambientais e soluções. In: DOMINGUES, Antônio Félix; BOSON, Patrícia Helena Gambogi; ALÍPAZ, Suzana. *A gestão de recursos hídricos e a mineração*. Brasília: Agência Nacional de Águas – ANA, Instituto Brasileiro de Mineração - IBRAM, 2006. p. 199-231.