USE ON PURIFIED SILICA IN THE CERAMIC FORMULATION

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1. ABSTRACT

The process of beneficiation of gold ore in geological zones containing quartzite produces a large volume of waste containing silica and other minerals constituent of the rock, the ferrous minerals being the most prominent and that gives the residue a reddish coloration. In order to use such residues as a source of silica for ceramic mass, techniques for reducing the impurities of the siliceous residue and their use as element of a ceramic mass for use in porcelain production were studied. The residue was submitted to mineral concentration techniques of gravimetric concentration was used to remove the minerals with a difference of density and magnetic concentrator to wet to remove ferrous impurities and in this way to eliminate minerals that give colour to the residue. An experimental design was carried out to determine the highest amount of residue to be added to the ceramic mass, in order to obtain the lower firing temperature and better physical properties of the ceramic part. The specimens were formed by uniaxial pressing in rectangular mold and dried at 60°C for 24 h, after drying were heat treated between 900°C and 1250°C. The raw materials were characterized

by diffraction of ray-x, fluorescence of ray-x, thermodifacial analysis, electron microscopy and the products subjected to water absorption, apparent porosity, linear retraction, density and mechanical strength tests. The reuse of the gold beneficiation presented: SiO_2=90%, Al_2O_3 =3,9%, Fe_2O_3=1,6%, MgO=1,4%, SO_3=1,3% end other=18%. Following the steps of gravity concentration and magnetic concentration, silica presented the following values: SiO_2 = 96,6%, Al_2O_3=2,6%, Fe_2O_3=0,25%, MgO=0%, SO_3=0,19%, other 0, 36%. The test specimens had properties suitable for use as a ceramic coating, and the best results for higher kcal temperatures.

2. INTRODUCTION

One of the ways to mitigate the environmental impacts produced by the mineral extraction activity is to promote the effective use of the largest number of minerals available in the deposit, either in the direct use of these or in the secondary recovery from the deposits deposited in tailings dam or stereo [1], [2].

Brazil is the country with the largest world reserves of quartz. However, since many of the companies operate in the mining regime and in a very rudimentary way, they do not have a technological base to add value and exploit the full potential of mineral use. Quartz has its use selected for its quality. The best quality crystals are intended for the optical, electronics and instrumentation industry (considered the largest consumers), while the lower quality crystals are intended for the general industry (abrasives, ceramics, metallurgical) [3], [4].

In this way, this work aims to obtain a process route, capable of obtaining silica in a satisfactory quality for use in ceramic pieces of high quality.

3. EXPERIMENTAL AND MATERIALS

The work was developed in two distinct stages: (i) processing and characterization of the mining tailings and (ii) preparation and characterization of ceramic test bodies.

A sample of waste from the gold extraction from a tailings dam was used, this sample was sieved until a 100% passing fraction was obtained at 74 µm and dried at 60°C for 48 h. The clay sample was from the city of Vitoria da Conquista-Ba/Brazil, which was dried at 60°C for 48 h and sprayed to 100% through 0.149mm.

The samples were characterized by diffraction ray-x (XRD), fluorescence ray-x XRF) and scanning electron microscopy (MEV). The XRD used the powder technique, with scanning from 3° to 90°, with step of 2°/min, using 30 kV and 30 mA. The XRF used steady-state tablet. The MEV used powdered metallized samples and analysed at high vacuum by retro-scattering electrons and EDS probe. The reject was subjected to gravimetric concentration in a concentrating shake table and magnetic concentration to wet type Jhones.

The specimens were made with the silica clay blends obtained in the magnetic concentrator (Si) at the proportions of 0, 10, 20 and 40% of Si. The blends were pressed at 20 MPa in the rectangular form of 20x60 mm. The range of temperatures were 900° C and 1100° C.

4. RESULTS AND DISCUSSION

The results of the XRD characterization and XRF of the mining residue (RM) indicated the presence of silicon oxide, quartz, goethite and pyrite and chemical composition of 90,80% of SiO_2; 3,90% of Al_2O_3; 1,60% of Fe_2O_3 and 1,40% of MgO, with SO_3 (1,3%), K_2O (0,54%) and TiO_2 (0,19%) being identified. In figure 1 we have the technological properties of the samples.

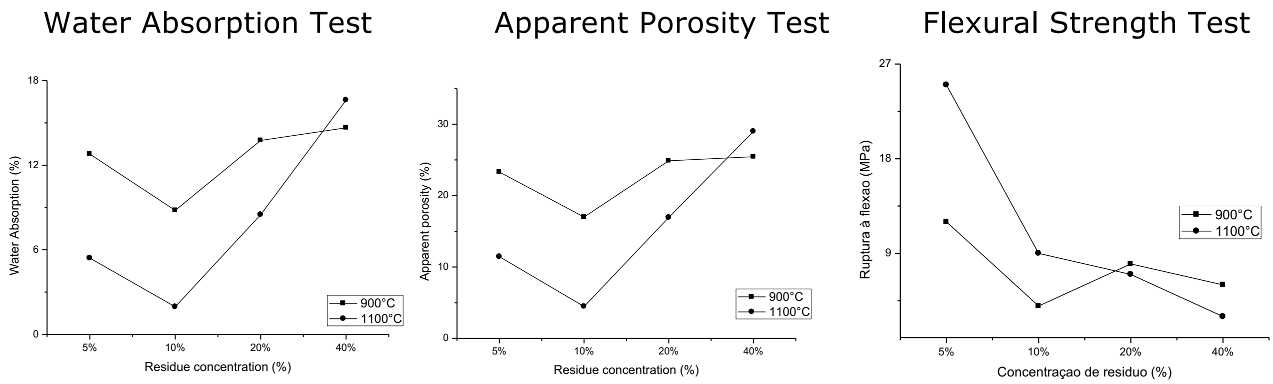

Figure 1: *Technological Properties.*

5. CONCLUSIONS

The use of this purified silica (si) allowed the preparation of ceramic pieces with low water absorption index and apparent porosity, being compatible with the characteristics of stoneware and semi-stoneware.

The modulus of flexural strength is drastically influenced by the addition of Si to the ceramic mass. Very low values of resistance (3 Mpa) were obtained with little accentuation (10%) of the residue, either for the firing temperature at 900°C or 1100°C.

In general, it is possible to use such a purified residue for the preparation of ceramic coatings, following the maximum silica addition limit of 5% and a firing temperature of 1100°C.

6. REFERENCES

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