Heteromorphic hematite pigments from steel scrap encapsulated in amorphous silica obtained from rice husk

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Abstract - The aim of this study was to investigate the possibility of recycling steel scrap and rice husk as alternative raw materials for the synthesis of an encapsulated pigment based on iron oxide and silica for application in the ceramic industry. For the synthesis of the pigment, the following compositions were defined: 5, 10 and 15 wt% of cromophorous, which were homogenized and calcinated from 1050 to 1150ºC for 2 h. The pigments showed stability after firing, turning into cream and light pink colors with different saturations according to the added percentage and inherent amount of cromophorous material for each composition.

For the obtainment of the ceramic pigment of iron oxide III (hematite) encapsulated in silica matrix using for that alternative raw materials such as rice husk and steel scrap, as silica (matrix) and hematite sources, two methods were followed.

The silica source was obtain throw rice husk leaching process, with 10 wt% hydrochloric acid with later calcination at 600ºC for 3h. The steel scrap sample treated at 800ºC during for 2h in oxidizing atmosphere generated hematite with red tonality. The iron oxide obtained from the steel scrap presented around 97 wt% hematite. The increasing importance of iron oxide pigments is also based on their non-toxicity, chemical stability, durability, wide variety of colours and low costs [1].

Pigments are used in the production of ceramic floor and wall ceramic tiles, either in glaze preparation or in porcelainized stoneware bodies, giving decorative and esthetical properties to the tiles, giving them an enjoyable look and frequently masking their defects [2]. The encapsulating model, is show in Fig. 1 [3].

In order to verify the pigment microstructure after the calcination and the consequent occlusion process, microscopical techniques were used The samples are show in the Fig. 2. The obtained results confirmed the possibility of recycling of rice husk and steel scrap as alternative sources of silica and iron oxide (hematite), for obtaining a ceramic pigment by the encapsulating method, turning then these industrial wastes into higher added value products.

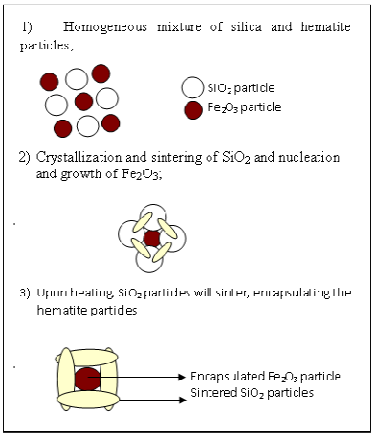

Figure 1 Encapsulating mechanism for the hematite pigment in amorphous silica.

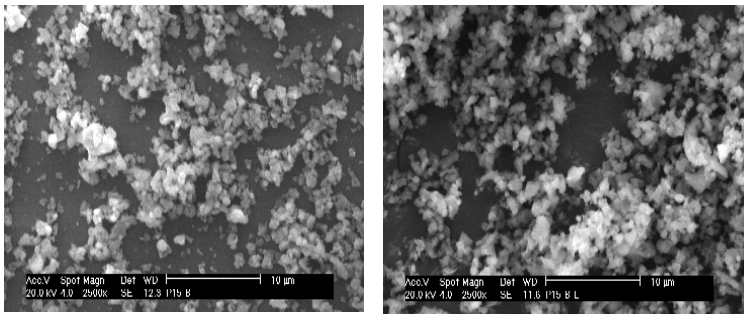

Figure 2 SEM micrographs showing morphological features of pigments P15-B and P15-B-L.

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