

Heteromorphic Hematite Pigments for Porcelainized Stoneware

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Abstract - In this work, a heteromorphic ceramic pigment of hematite encapsulated in silica was used in the porcelainized stoneware processing. Hematite (chromophorous) and amorphous silica (matrix) were obtained from alternative raw materials steel scrap and rice husk. Pigments were synthesized with 5, 10 and 15 wt% hematite, calcined at 1050 and 1150°C for 2 h. The calcined pigments were applied (10 wt%) in porcelainized stoneware bodies before and after removing the non-encapsulated, free hematite. It was verified that the synthesized pigment developed a light pink color, and that the present non-encapsulated hematite fraction didn't cause any distortions on the color development.

The porcelainized stoneware is currently the ceramic tile that presents the best technical and esthetical features. Such success is due to an extensive technological development process, which allowed the elaboration of a material constituted by crystalline phases of high toughness and mechanical strength [1]. Fe_2O_3 is applied in porcelainized stoneware in order to give a dark pink color.

The pigment samples were formulated as follows: 85, 90 and 95 wt% silica (5, 10 and 15 wt% hematite). In order to verify the thermal and chemical stability, as well as the post-application optical properties, the hematite pigments (4 and 8 wt%) were incorporated in porcelainized stoneware. A porcelainized stoneware body and pigment mixture was obtained after wet milling in ball mill and drying at 110°C until a constant weight was reached. 7 wt% water was then added to the mixture. Cylindrical specimens were compacted in a laboratory press at 450 kgf/cm². The disks were dried and fired at 1220°C for 60 min.

Figure 1 show the aspect of porcelainized stoneware, which was pigmented with free hematite synthesized from steel scrap. The samples developed a very saturated red color tending to brown. It can be also noticed that the surface presents a wrinkled aspect. Both features may be due to interaction of hematite with body components. This is specially observed for the 8 wt% hematite sample, due to the low chemical and thermal stability that the iron presents when used in its free form. [1].

Samples of fired porcelainized stoneware pigmented with encapsulated hematite are presented in Figure 2 and 3. After firing, the samples with encapsulated hematite pigment presented surfaces with smooth texture and uniform coloring, for all pigment and the chromophorous fraction added, with a color variation between rose and dark pink.

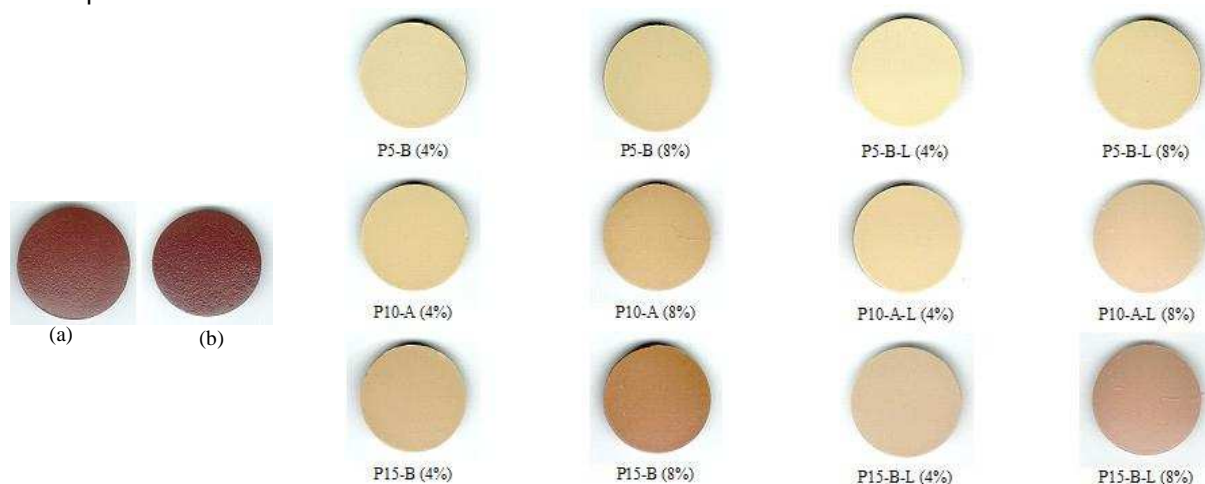


Figure 1 Visual aspect of porcelainized stoneware samples pigmented with (a) 4 wt% and (b) 8 wt% free hematite.

Figure 2 Visual aspect of porcelainized stoneware with non-leached hematite pigments.

Figure 3 Visual aspect of porcelainized stoneware with leached hematite pigments.

[1] Società Ceramica Italiana (SCI). Colore, pigmenti e colorazione in ceramica. S.A.L.A. Modena: Italia, (2003),360.