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UTILIZATION OF Mn-Fe SOLID WASTES FROM ELECTROLYTIC MnO_2 PRODUCTION, IN THE MANUFACTURE OF CERAMIC BUILDING PRODUCTS

C. SIKALIDIS[1] and V. ZASPALIS[2]

[1]Department of Chemical Engineering, Aristotle University of Thessaloniki,
P.O.Box. 1683, 54006 Thessaloniki, Greece. E-mail: sikalidi@eng.auth.gr
[2]Chemical Process Engineering Research Institute, 57001 Thessaloniki, Greece

EXTENDED ABSTRACT

Thousands of tones per year of Mn-Fe solid wastes which come from electrolytic MnO_2 production affect by their disposal the soil and water quality, represent a wastage in economic terms and their administration becomes increasingly difficult the greater their bulk. On the other hand, manganium and iron compounds are used as pigments for ceramic products and cement based products. The aim of the present work is to investigate the presuppositions and the effect of the addition of the Mn-Fe solid wastes in the ceramic batch formula and on the properties of ceramic building products.
Chemical, mineralogical and particle size distribution analyses were performed in order to characterize these wastes. Changes on their mineralogical characteristics after their thermal treatment were investigated by x-ray diffraction analysis. Ceramic specimens were prepared by powder pressing and ceramic plastic mass extrusion, after the addition of various percentages (2.5, 5, 7.5 and 10 wt%) of Mn-Fe solid wastes in the ceramic mass used and after firing at various peak temperatures (950, 1000, 1050 and 1100 ^oC). The ceramic specimens were tested for weight loss, firing shrinkage, water absorption and modulus of rupture. Ceramic glazes were also prepared by the addition of thermally treated wastes in a borosilicate frit. Ceramic glost specimens were prepared, by applying the prepared glazes on the ceramic substrates and by firing at 1000 ^oC peak temperature. The ceramic glost specimens were tested for crazing resistance, resistance to chemical attack and color appearance and stability.
The particle size distribution (99.7% < 125μm) indicates that the addition of the wastes, even in small quantities, in the ceramic batch can give a homogeneous mixture. The main new phases appeared after the thermal treatment of the wastes (Mn_2O_3, Fe_2O_3 etc) strongly affect the color of the ceramic specimens. They also had a positive result on sintering and microstructure. This was confirmed by the firing shrinkage, the weight loss and the water absorption values. The addition of 5.0 to 7.5wt % seems to give the best results.
The water absorption values for powder pressed specimens were reduced with the addition of 7.5 wt% wastes B and after firing at 1100 ^oC peak temperature, from 8.8 to 6.4 wt %, while the mechanical strength (modulus of rupture) was improved accordingly from 99.9 to 128 kgf/cm^2. Similar results were observed for extruded ceramic specimens.
The colors of the ceramic specimens obtained were all of them acceptable and were connected to the added percentages of the wastes. Were ranged from light and medium brown with 5 wt% addition of wastes B, to dark brown with 7.5 wt% addition and to much darker brown with 10 wt% addition. The glost specimens showed no crazing and good resistance to chemical attack. The color of the glost specimens was medium brown.
These results suggest that the Mn-Fe wastes generating from the production of electrolytic MnO_2 can be utilized in the production of building ceramics, decreasing the environmental problem (affection of soil and water quality) caused by their disposal.

Key words: Electrolytic MnO_2, Mn-Fe wastes, utilization, ceramics, glazes, water absorption, mechanical strength, firing shrinkage, weight loss, crazing resistance, chemical attack, color.