CHARACTERISATION OF ZINC IRON CHROMITE PIGMENTS USING ELECTROPLATING WASTE AS RAW MATERIAL

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1. INTRODUCTION

The solid waste in the effluent treatment from the galvanization process, i.e. its sludge, has received special attention due to the nature of its constituents. This waste contains in its composition, a high concentration of alkaline and transition metals. Inadequate discharge or storage of this waste could harm the environment and health. This work proposes an alternative for the inertization of galvanic wastes incorporating them into inorganic pigments formulation. In general, such inorganic pigments are formed by metallic oxides, which after thermal treatment form crystalline crystals. The sludge was classified as class II – non-inert, through leaching and solubilization tests according to standard NBR10004.

2. MATERIALS AND METHODS

To incorporate the sludge into inorganic pigment formulations, it was characterized by elemental chemical analysis techniques such as X-ray fluorescence and atomic absorption spectroscopy; it was also characterized by thermogravimetry and x-ray diffraction.Chrome, iron and zinc oxides with the waste were used for pigment formulation. The waste underwent thermal treatment at 550°C for 2 hours, in order to eliminate volatile compounds present. Waste additions of 30%, 20%, 10%, 5% by wt were incorporated into the pigment formulation. The control of the raw materials was made on sieve 325 mesh with less than 8% residue. The mixtures were heat treated in an electric furnace at 1200°C temperature for 4, 6 and 8 hours, applying a heating rate of 5°C/min.The pigments obtained were characterized by X-ray diffraction, with a Philips model X'Pert instrument with copper radiation Ka (l = 1.5418 A), with 0.05° step, time of step 1s and measure interval in 2θ (from 5 to 80°). The phases present were identified using the JCPDS database and Rietveld.

3. RESULTS AND DISCUSSION

In the study we compared the mineralogical composition of the pigment system Fe-Cr-Zn obtained from a mixture of the residue with pure oxides with a standard sample of commercial pigment ceramic. The comparison performed by X-ray diffraction showed the major presence in the mixture of crystalline structures of the spinel type: $FeCr_2O_3$ and $ZnCr_2O_3$ of the sample roasted at 1200°C for 8 hours with 20 wt% residue.

The experiments conducted show the viability of obtaining ceramic pigments by recycling the waste produced in the electroplating process. However, the studied residue presented certain difficulties in its characterization, because of being a mixture resulting from different phases of the surface treatment process of the metallic pieces. This made it particularly important to know the production process and origin of the residue involved.

The possibility of incorporating this waste in the formulation of inorganic pigments that present spinel type structures was observed. It was observed, based on the X-ray diffraction analysis results, that the metals present in the waste became inert.

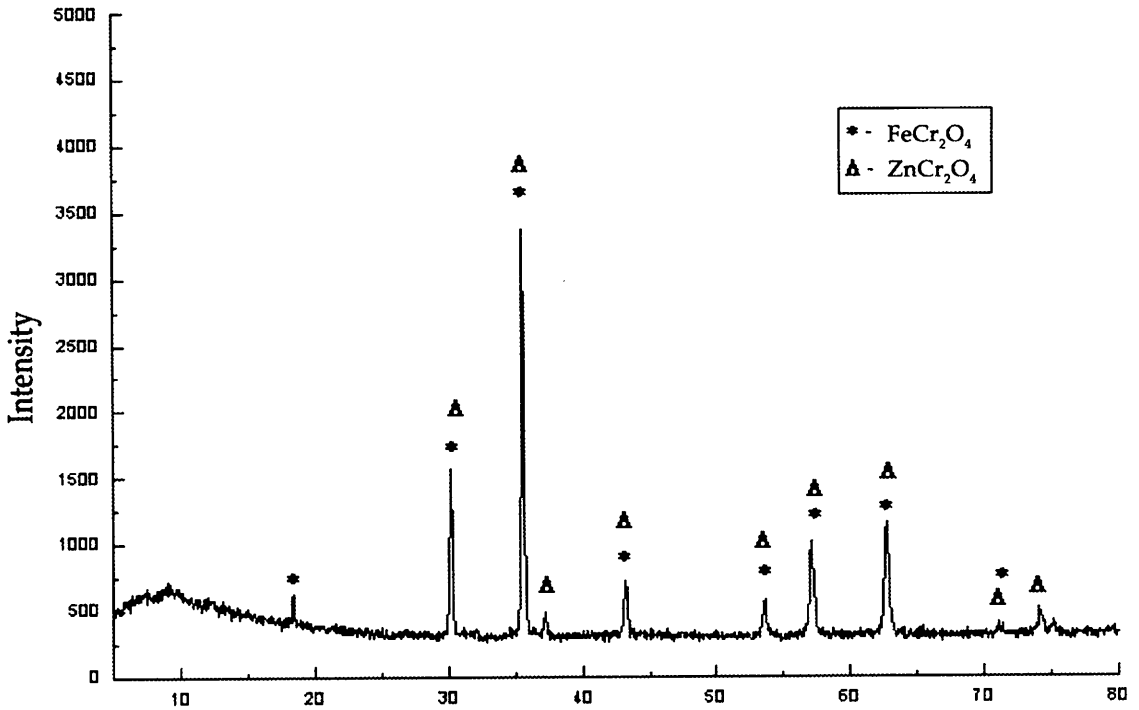

Figure 1. X-ray diffractogram of pigment obtained with 20% of the waste.

4. CONCLUSIONS

With the incorporation of electroplating waste we obtained a brown inorganic pigment with good dispersion in the enamel and appropriate thermal stability, in comparison with commercial pigments obtained by the same oxides.

The pigments calcined with an 8 hour cycle formed crystalline spinel phases, in which we can say that the metals present in the sludge became inert. It was possible to incorporate up to 20% of the electroplating waste in the production of Fe, Cr and Zn based inorganic pigments.