EVALUATION OF CONTAMINATED MORTARS WITH ZINC BY ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY

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ABSTRACT
In this research the mortars were evaluated with the contamination of heavy metals. The heavy metal studied was the Zinc. Some solid wastes incorporated in the mortars have shown zinc in their composition. The contaminated mortars were submitted to electrochemical impedance spectroscopy (EIS) during the period of cure, until 28 days of age. The objective of this study is evaluating the possibility of heavy metals detection through electrical method and their relationship with leaching procedures.

Keywords: contaminated mortars, heavy metals, electrochemical impedance spectroscopy.

INTRODUCTION
The incorporation of solid wastes in the cementitious materials has been an object of study in view of environment pollution and disposal problems, but also in the reduction of cost of new construction materials. However, this contamination with the heavy metal require of appropriate actions after incorporation, avoiding a new environmental contamination.

Through of leaching tests it is possible find the final concentration and the liberation velocity of the contaminants (diffusivity). However, these properties are physio-chemical changes that occurred due to heavy metals incorporation, which are present in the solid wastes. And these changes happen before the submission of the mortars into the leaching test, on hydration period of the mortars. The electrochemical impedance spectroscopy (EIS) can be used in the contaminated mortars evaluating the hydration process and the physio-chemical changes due to presence of the heavy metals and others contaminants in the cementitious materials. This electrical method is fast and allows an analysis in situ of the contaminated materials.

RESULTS AND CONCLUSIONS
The spectrums of contaminated mortars with 100 and 200 ppm of zinc showed two or three arcs (Fig. 1b and Fig. 1c). The cementitious materials show a spectrum with one arc (CABEZA M. et al., 2006; RAVIKUMAR D. and NEITHLATH N., 2013; VEDALAKSHMI R. et al., 2009, etc.). This formation of spectrum with more of one arc refers to material with several crystalline phases. Each intersection point of spectrum in the axis Z' (real part) refers to different of interface region. These new phases were identified in the work of Chen Q. Y. et al. (2007). In this research occurred the reaction of zinc with the tricalcium silicate resulting one new compound, the calcium zincate hydrated (CaZn2(OH)6.2H2O). Other important characteristic of spectrum is the increasing of the electrical impedance with the mortars age. When the Portland cement is hydrated the water content decreases. How the water conducts the electrical current, the conductivity of the mortars decreases. However, In Figure 1d, the
electrical resistance doesn’t increased in all periods analyzed. This fact also was showed in the research of Schwarz N. et al. (2007).

Fig. 1 - (a), (b) and (c) Spectrums of contaminated mortars with zinc during the hydration process and (d) the electrical resistance of the mortars on 28 days of age.

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REFERENCES