CORROSION STUDY OF STEEL IN CONCRETE PROBES IN ABSENCE OF OXYGEN THROUGH EIS TECHNIQUES, LINEAR POLARIZATION METHOD AND CHRONOPOTENCIOMETRY

E.García, J.Torres, N.Rebolledo, J.Sánchez

Reinforced concrete is a material widely used in construction due to its excellent properties and its great versatility. The main cause of concrete structures deterioration is the corrosion of the steel bars due to the ingress of many aggressive agents like chloride. The objective of this work is to study the corrosion evolution of reinforced concrete in an environment of low oxygen content and in presence of chloride ions. Such conditions simulate the behaviour of an offshore structure.

In this experiment 3 10*10*10 probes made with type I 42.5R cement were used. NaCl was added to the mixing water to a 2% w/w total content of chlorides. Steel 6 mm diameter bar were embedded in each probe.

After one day of curation, the probes were demoulded and immersed in a NaCl 30 g/L solution. The whole set-up was put in a gloves chamber and the oxygen was removed with a nitrogen stream.

Corrosion of the probes was measured by means of electrochemical methods of electrochemical impedance spectroscopy EIS, Linear Polarization Resistance (LPR), and Chronopotentiometry. These three techniques provide us the values of corrosion potential, ohmic drop (except LPR) and polarization resistance value, used to deduce corrosion velocity.

According to the preliminary results of this test, the following conclusions could be draw: i) The three techniques usually provides the same results in the LPR measure, except in cases when the probe is highly active where the values obtained by means of due to EIS are much lower in relation with LPR and Chronopotentiometry methods; ii) under the oxygen absence, corrosion potentials during practically the whole test have maintained far below -350 mV. This value is the threshold potential for considering the activity or passivity of steel in concrete. However, it has to be noted that corrosion velocity sometimes remain in values to be considered like actives ($I_{corr} > 0.2$ µA/ cm^2) and sometimes were passive ($I_{corr} < 0.2$ µA/ cm^2).