

## **Evaluation of the nano silica and nano waste materials on the corrosion protection of high strength steel embedded in ultra - high performance concrete**

Corrosion resistance of high strength steel (HSS) embedded in ultra-high performance concrete (UHPC) immersed in 3.5% NaCl solution is evaluated in the absence and presence of nano silica (NS), Nano glass waste (NGW), nano rice husk ash (NRHA) and nano metakaolin (NMK) using open circuit potential, potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) under normal and accelerated conditions. Data showed that the corrosion rate in the accelerated conditions is higher compared by the normal conditions due to the increasing in the rate of both anodic and cathodic reactions in the presence of anodic current. On the other hand, the presence of the studied nano materials decreases both the anodic and cathodic over potentials, and shifts both the open circuit potential ( $E_{ocp}$ ) and corrosion potential ( $E_{corr}$ ) of HSS to more noble values, as well as decreases the values of the corrosion current densities ( $I_{corr}$ ) in both normal and accelerated conditions. Furthermore, EIS analysis illustrates that the presence of these materials enhances both the concrete bulk resistance and the charge transfer resistance at HSS/UHPC interface, which retards the flow of the electrons between the anodic and cathodic sites, thus impeding the propagation of the corrosion process. The inhibitory effect of the studied nano materials for the corrosion of HSS is interpreted on the basis of the change in the microstructure and the compressive strength of the UHPC.