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## **Design of silicon nanoparticles to improve the barrier effect on hardened Portland cement-based materials**

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Concrete permeability is a property directly involved in all deterioration mechanisms affecting Reinforced Concrete (RC) structures. This permeability derives from the porous nature of the concrete, and it has an effect on the entrance of aggressive agents ( $\text{Cl}^-$ ,  $\text{CO}_2$ ,  $\text{SO}_4^{2-}$ ), that may lead to the accelerated degradation of RC structures. The present study investigates the effect of the size of silicon nanoparticles (SN) and its application time through an electric field, in order to reduce the formation time of the barrier effect on hardened Portland cement-based materials. The SN were synthesized by Sol-Gel method using the following conditions: room temperature ( $25^\circ\text{C} \pm 2^\circ\text{C}$ ),  $\text{C}_2\text{H}_6\text{O}/\text{Si}(\text{OC}_2\text{H}_5)_4$  ratio=33.34 and different quantities of water (10-50 mL). By DRX was found the synthetic materials have a characteristic amorphous phase of  $\text{SiO}_2$ . The TEM images show that the effect of the hydration level in the size and morphology of the SN, obtaining sizes in the range of 200-80 nm. The SN of 200, 180 and 80 nm were introduced in different specimens through an electric field of 20V of DC for 1 and 4 h. To verify the effect of these variables in the formation of barrier effect, the specimens were characterized by techniques of Electrical Resistivity and Porosity, in order to evaluate the formation of barrier effect. Favorable formation times starting from 28 days, using NS 200 nm.

### **Biography**

J R Madrigales Ubaldo has completed his Bachelor Degree from UANL. He has worked by four years in different industries like Vitro, CEMEX and Pyosa. In 2014 he started his Master of Science.

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