Electrochemical chloride extraction treatment on chloride contaminated concrete

Abstract

Traditional patch repair is not that effective in treating corroded reinforcement due to chloride ions. A novel technique for dealing with this problem is by chloride extraction. The electrochemical extraction of chloride from concrete is accomplished by applying an anode and electrolyte to the concrete surface and passing direct current between the anode and the reinforcing steel (as cathode). Negatively charges ions (Cl–and OH–) migrate toward the anode and at the same time positively charged ions (Na+ and K+) migrate toward the cathode. To simulate experimentally the effect of applying electrochemical chloride extraction to reinforced concrete, rectangular prism specimens of hydrated cement paste containing sodium chloride were subjected to electrolysis between embedded steel cathodes and external anodes of activated titanium mesh. The cathodic current density used was 5 A/m2 with the treatment period of up to 12 weeks. After treatment, the specimens were sectioned and analysed to determine changes in the distribution of ions within the pore solution phase and the total chloride content. It was found that electrochemical chloride extraction (ECE) capable of reducing free and bound chloride and at the same time increased the pore solution alkali concentrations near the embedded steel. The effect of ECE treatment towards the physical and microstructural properties of cement was studied by using microhardness and MIP technique. XRD technique was employed to look at the possibility of ettringite formation. ECE had caused some changes in physical and mechanical properties of the cement matrix. However these charges are very minimal and in the case of microhardness, the results were scattered and cannot be proven statistically.