STRAY CURRENT INDUCED CORROSION OF STEEL FIBRE REINFORCED CONCRETE

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Abstract

Stray current induced corrosion represents a major technical challenge for modern electrified railway systems. The leakage of stray current to surrounding reinforced concrete structures can lead to steel reinforcement corrosion and the subsequent disintegration of concrete. Steel fibre reinforced concrete has been increasingly used as the railway tunnel lining material in the UK since the construction and operation of the Channel Tunnel when it was first used as the primary railway tunnel lining material. There is however still a lack knowledge concerning the susceptibility of stray current induced corrosion of SFRC and no recognised methodology that is suitable to assess it. Corrosion behaviour of steel fibres has been investigated through instrumental methods in electrochemistry including voltammetry tests and electrochemical impedance spectroscopy. The presence of high concentration chloride was found to increase the pitting corrosion tendency of steel fibres in simulate concrete pore solutions and mortar specimens. The chloride threshold level for corrosion of steel fibres in concrete is approximately 4% NaCl (by mass of cement) which is significantly higher than that of conventional steel reinforcement. Based on this information, SFRC can become an ideal substitute for conventional steel reinforcement in electric railway systems, with less concern about stray current induced corrosion.