Performance of reinforcing steel in alkali-activated mortar under accelerated corrosion

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Abstract

Alkali-activated materials (AAMs) are a group of alternative binders based on an alkali activator and an aluminosilicate powder, such as fly ash or slag. Alkali-activated materials have been shown in the literature to have similar mechanical properties to Portland cement and higher durability in non-structural applications with lower carbon emissions, making them a promising binder for the future. However, the information related to reinforcement durability is not sufficient and coherent with standard limits to allow full application and approval of AAMs.

In AAMs, the high pH of the pore solution favours the passivation of embedded steel in reinforced alkali-activated concrete, but the different chemical composition and redox conditions in the steel-concrete interference region strongly affect the structure of the passive film and its stability. For these reasons, the electrochemical limits (such as in standard ASTM C 87) widely used to evaluate steel stability may not be suitable for steel embedded in AAMs. Therefore, the aim of this study is to monitor the steel stability under induced corrosion with constant voltage in a simulated seawater environment by open circuit potential, linear polarisation and Tafel slope extraction. The electrochemical results are validated by comparing the electrochemical mass losses with the mass losses obtained from the gravimetric measurements.