Study on the Setting and Hardening Process of red mud-coal metakaolin geopolymer concrete by Electrochemical Impedance Spectroscopy

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The setting and hardening of red mud-coal metakaolin geopolymer concrete (RCGC) was studied. To this end, four sets of RCGC blocks with different water-binder ratios (0.50, 0.55, 0.60, and 0.65) were prepared. The workability, setting time, and compressive strength of four RCGC specimens with different water-binder ratios were evaluated. The electrochemical performance of RCGC was analyzed by electrochemical impedance spectroscopy (EIS), and the process of coagulation and hardening was analyzed through equivalent circuit parameters. X-ray diffraction (XRD), nuclear magnetic resonance (NMR), and scanning electron microscopy-energy dispersive analysis (SEM-EDS) were used to investigate the coagulation and hardening mechanism of RCGC materials. The experimental results show that the increase of the water-binder ratio prolonged the setting time of RCGC and increased the slump. There is a good linear relationship between the compressive strength and the impedance parameters $R_s$ and $R_{ct}$. Over time, the pores of the material are gradually filled with coagulation and hardening products, and the microstructure is gradually developed.

Keywords: Geopolymer concrete; Electrochemical impedance spectroscopy; Nuclear magnetic resonance test; Compressive strength; Microstructure.

FULL TEXT

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