Fire retardant performance of rice husk ash-based geopolymer coated mild steel - a factorial design and microstructure analysis

ABSTRACT

Higher content of silica in geopolymer coating resulted in better thermal properties. Since rice husk ash (RHA) has the highest silica content compared to other aluminosilicate sources available, it offers the best potential to be an alternative silica source in producing geopolymer coating binder. In this study, five factors including ratio of alkaline activator (AA) (A), ratio of RHA/AA (B), curing temperature (C), curing time (D) and concentration of NaOH (E) were analyzed using statistical analysis to identify the significant factors that mostly influence fire retardant performance of RHA-based geopolymer coating. The fire retardant tests were conducted and results recorded included (i) time taken to reach 300°C and (ii) temperature at equilibrium. Sample S7 (coating composition of A=5.5, B=0.3, C=50°C, D=7days, E=8M) which produced the best fire retardant performance was selected for further detailed investigation using thermogravimetry analysis (TGA) and scanning electron microscopy (SEM). It was found that the back temperature of mild steel plate of sample S7 reached 300°C after 17 minutes and achieved an equilibrium state at 398°C. SEM micrographs showed the presence of needle-like structures formed after fire test might be the reason for the best fire performance of sample S7.

Keyword: Fire retardant; Geopolymer coating; Intumescent coating; Mild steel; Rice husk ash