

## **Preparation and hydration mechanism of low shrinkage railway sleeper concrete containing hot steaming steel slag**

### **ABSTRACT**

The cascade grinding technology was used to produce cementitious materials with hot steaming steel slag (SS), iron ore tailings (IOT), granulated blast furnace slag (GBFS), cement clinker (CC) and flue gas desulfurization gypsum (FGDG). The effect of SS on the mechanical properties and autogenous shrinkage of railway sleeper concrete and the mechanism of SS inhibiting the autogenous shrinkage of railway sleeper concrete were studied by means of X-ray diffraction (XRD), Fourier transform-infrared spectroscopy (FT-IR), and scanning electron microscope (SEM). The results show that the compressive strength of IOT railway sleeper concrete mixed with SS (SIRSC) is lower than that of IOT railway sleeper concrete unmixed with SS (UIRSC) at the same age. However, autogenous shrinkage of SIRSC is significantly lower than that of UIRSC, autogenous shrinkage value of SIRSC at 28 d was  $230 \times 10^{-6}$ , while that of UIRSC was  $593 \times 10^{-6}$ . The hydration mechanism analysis shows that the hydration expansion of a small amount of inert f-CaO and f-MgO phase contained in the SS is the main expansion source to restrain the autogenous shrinkage of SIRSC. The f-CaO and f-MgO phases are highly dispersed after superfine grinding SS is mixed with concrete. In the middle and later stage of concrete hardening, the synergistic growth of ettringite (Aft) and C-S-H gels inhibits the autogenous shrinkage of SIRSC and improves the mechanical properties.