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On the Thermal Behavior of the Slab in a Reheating Furnace with Radiation

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Abstract : A mathematical heat transfer model for the prediction of transient heating of the slab in a direct-fired walking beam type reheating furnace has been developed by considering the nongray thermal radiation with given furnace environments. The furnace is modeled as radiating nongray medium with carbon dioxide and water with five-zoned gas temperature and the furnace wall is considered as a constant temperature lower than furnace gas one. The slabs are moving with constant velocity depending on the residence time through the non-firing, charging, preheating, heating, and final soaking zones. Radiative heat flux obtained by considering the radiative heat exchange inside the furnace as well as convective one from the surrounding hot gases are introduced as boundary condition of the transient heat conduction within the slab. After validating thermal radiation model adopted in this work, thermal fields in both model and real reheating furnace are investigated in terms of radiative heat flux in the furnace and temperature inside the slab. The results show that the slab in the furnace can be more heated with higher slab emissivity and residence time.

Keywords : reheating furnace, steel slab, radiative heat transfer, WSGGM, emissivity, residence time
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