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XANES Iron K-Edge Speciation of Corroded Tube upon Victorian Brown Coal Oxy-Fuel Combustion

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Oxy-fuel combustion is the burning of coal in the mixture of recirculated flue gas and high-purity oxygen, so as to reduce the carbon emission from coal-fired power plant. The fly ash - related fouling and corrosion are some of the most crucial issues encountered in this process. Understanding tube corrosion in this new combustion process is pivotal for a successful adoption of this technology by the existing power plants. In this work, we have employed a horizontal furnace to study the fly ash-related tube corrosion at 650 oC for the duration of 50 hr in air versus oxy-fuel combustion mode. Six tubes and five different ashes have been tested. The cross-section of the tube after exposure test was studied by using optical microscopy (OM), scanning electron microscopy (SEM) coupled with energy dispersive spectroscopy (EDS), and synchrotron X-ray absorption near edge spectroscopy (XANES). As have been confirmed, the corrosion of tube surfaces was substantially accelerated under the oxy-fuel combustion condition, as compared to air. The ash composition also affected the extent of the tube corrosion. With regard to different tube materials, it was found that, SUS347 and T23 steel were corroded most intensively, whereas SS400 was affected slightly by flue-gas composition.

Keywords

Oxy-Fuel Combustion, Victorian brown coal, Tube Corrosion, Fe XANES

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