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The Reactivity of Coke to SO_3

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SUMMARY

An apparatus and technique have been developed for determining reactivity, under closely controlled temperature, of cokes prepared from coals of varying rank. The cokes used were prepared by carbonisation at 600°C and at 960°C and the reactivity was determined over the temperature range 100 - 500°C.

For all the cokes, the extent of sulphur trioxide reduction increases with temperature, in a complex manner, although cokes derived from low-rank coals are the most reactive. The mechanism of reaction between coke and sulphur trioxide is briefly discussed.

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(1) Introduction

The extent of deposits and corrosion on the heating surfaces of water-tube boiler plants is known to be largely dependent on the SO_3 content of the flue gases. Consequently if a reduction in the SO_3 concentration can be achieved either by inhibition of its formation or by converting it to SO_2, some alleviation of the deposit and corrosion problem should result.

In this connection there is a certain amount of information which indicates that carbon particles, over a wide size range, are efficient in reducing SO_3 to SO_2. Laboratory work by Whittingham[1] and Kear[2] has shown that the presence of carbon smokes in a flue gas containing SO_3 reduces both the SO_3 content and the corrosion of steel surfaces exposed to flue gases, while Crossley, Poll and Sweett[3] have shown that complete reduction of SO_3 to SO_2 was effected when SO_3 was passed through a bed of sized coke at temperatures of 300 - 400°C.

Observations on an experimental boiler plant[4] have shown that the introduction of hydrocarbon smokes to the gases at the rear of the furnace decreased the quantity of deposits, and more recently it has been shown[5] that when burning mixtures of coal and coke breeze, the