

A B S T R A C T

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The methods of Thermogravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC) have been successfully applied to estimate the process variables which describe in-situ combustion.

Crude oil from Iola County, Kansas having 19.3 °API gravity and 223 cp viscosity at 38 °C was heated from ambient to 600 °C at 10 °C/min. in air flowing at 30 cm³/min. Data from the TGA thermogram was used to develop a kinetic model from which the percentages by weight of the crude components which undergo reactions were estimated. Off-gas analysis experiments were further carried out using the TGA unit in connection with a gas chromatograph to determine the nature of these reactions occurring during the burning process. From this it was concluded that the main transition stages are distillation, low temperature oxidation, cracking and combustion.

The kinetic model was used to predict the percent-

age of crude which is utilized as fuel in the combustion. The time for the fuel within the combustion zone to be consumed was also estimated.

By estimating the length of the combustion zone from heat balance considerations the rate at which fuel is consumed during the process was also predicted.

Combustion tube runs were carried out to test the predictions which were made using the methods of Thermal Analysis. The results of this run were in very good agreement with those predicted.

The fuel heat value and the heat availability during the process were also estimated by DSC techniques, however, these values were lower than those obtained from the tube. This was attributed to the increase in the heat value of the crude in the combustion tube due to low temperature oxidation and distillation effects downstream of the combustion front.