COAL MINERAL TRANSFORMATIONS – EFFECTS ON BOILER ASH BEHAVIOUR

OBJECTIVES

The range of coals encountered by new and existing power stations in the UK and abroad is steadily increasing. The inorganic component – the mineral matter – of coal impacts directly on plant availability through coal ash slagging, emission limits especially for fine particulate material and ash use and disposal. These factors constrain the acceptable range of coals for power station use. This project addresses the lack of fundamental understanding of the processes and rates of coal ash formation. It also considers the inability to predict boiler ash properties and behaviour because of a lack of detailed numerical descriptions for fly ash. The objectives of this project are:

- to improve understanding of the transformations undergone by major coal minerals during pulverised coal combustion
- to provide quantitative data on the rates of coal mineral transformations
- to provide quantitative descriptions of boiler ashes, especially finer ash particles, for modelling boilers and precipitators using computational fluid dynamics
- to improve understanding of the effect of coal mineral transformations on the processes of boiler ash formation, deposition, emission and disposal

SUMMARY

A wide range of coals, characterised by their mineral and organic constituents and of interest to UK and overseas power station operators, will be selected for the study. Combustion performance and coal mineral transformations will be studied at a power station, at Powergen's 1 MW combustion test facility and in the high-temperature entrained flow reactor (EFR) at Imperial College. The interactions between coal minerals will also be investigated in the EFR under a range of combustion conditions. The chemical and physical properties of the resulting ash samples – particularly the smallest particles – will be characterised by computer-controlled scanning electron microscopy.

The effects of temperature, residence time, oxygen concentration and association with coal organic material on the transformations of major coal minerals will be determined, and the interactions of coal ash particles following deposition will be investigated. The implications of the coal and ash properties and transformations on the wider aspects of pulverised coal-fired power station operation will be considered.

Coal suppliers and power station operators will benefit from quantitative data describing boiler ashes and their parent coal minerals, improved understanding of the transformations undergone by major coal minerals during pulverised coal combustion and the effect of these transformations on boiler ash formation and deposition processes.

COST

The total cost is £418 600 of which the DTI is contributing £198 600

DURATION

3 years beginning March 2000

CONTRACTOR

Imperial College of Science, Technology and Medicine – Department of Materials

In collaboration with

TXU Europe Power Ltd
Powergen UK plc
Rio Tinto Technology Development Ltd
Nottingham University, School of Chemical, Environmental and Mining Engineering

(Image courtesy of Chris Moyse)

The high-temperature entrained flow reactor at Imperial College

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CLEANER COAL TECHNOLOGY PROGRAMME

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