INTERFACES BETWEEN COKE CONSTITUENTS

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Introduction

Interfaces between coke textural components have been the subject of comment[1] but no attempt to classify them has been made and so their importance as regards coke strength is not known The work described in this paper forms part of programme designed to fill this gap in knowledge.

In petrographic terms, coal constituents are divided into reactives, ie. those vitrinites and liptinites which soften on heating, and inerts, which do not[2]. Correspondingly, a coke textural component is here referred to as reactive or inert if it originated from a reactive or inert coal constituent. Interfaces in cokes can occur between two reactives or a reactive and an inert. The primary objective of this initial study was to examine, using polarised light microscopy (PLM), interfaces between components in cokes obtained from six individual coals, to classify the interfaces present according to their perceived quality, and to quantify the quality of the interfaces present.

Experimental

The cokes examined were produced from six single-coal charges using a 0.6kg oven[4]. Characterisation data for the coals, all of UK origin, are given in Table 1.

Samples for PLM examination consisted of 60mm diameter epoxy-resin blocks the polished upper surface of which contained 10 to 16 approximately 10mm square coke surfaces.

Results and discussion

Examination of the cokes using PLM indicated that interfaces between textural components could be classified into four categories, termed transitional, fused, fissured and unfused, according to their appearance as described in Table 2. Because no evidence of fissuring is detectable at the interface, transitional and fused interfaces are regarded as 'good' interfaces while fissured and unfused interfaces are 'poor'. Using this classification, and applying a point-counting procedure in which, for each field of view, the interface nearest to the cross wires was allocated to one of the four categories described in Table 2, the interfaces in cokes could be quantified for comparison purposes. The identity of the textural components at the two sides of the interfaces was also noted.

Data obtained by point-counting interface types in the six single-coal cokes are shown in Figure 1. For this group of cokes, as the rank of the parent coal decreases from A to F and the textural components present changes from primarily flow to primarily mosaic components, the number of transitional, fissured and unfused interfaces tends to fall and increases in the number of fused interfaces occur. The data suggest the possibility of a minimum and maximum occurring for the transitional and fused interfaces respectively near the middle of the rank range.

To convert interface counting data into a single parameter reflecting the quality of interfaces observed, an interface quality index, Q, was defined arbitrarily according to:

$$Q = (T + Fu) / (Fi + U)$$

where T, Fu, Fi and U are the percentage observations of transitional, fused, fissured and unfused respectively. The calculation has been carried out using data for all the interfaces present to obtain an overall interface quality index for a coke, but the same approach has also been used to calculate quality indices for reactive/reactive and reactive/inert interfaces.

The values of Q for the six single-coal cokes are compared in Figure 2. As the rank of the coal decreases, the interface quality of the cokes, reaches a maximum value for the high-dilatation coal D and then falls. Interface quality of the coke is not however directly related to the total dilatation of the coal; coal F has low total dilatation but its coke has high interface quality.

For the six cokes examined, interface quality indices for reactive/reactive, reactive/small inert and reactive/large inert interfaces are also compared in

Figure 2. The interface quality index is very much higher for reactive/reactive interfaces, (the values in Figure 2 are one-twentieth of the true values) than for those interfaces involving inerts but a similar pattern for the variation of interface quality with coal carbonised is evident.

Comparing the overall interface quality indiex and the tensile strength of the cokes, both values are included in Table 1, shows that although the coke with the highest tensile strength also has the highest interface quality index, interface quality, as presently expressed, does not appear to correlate closely with the tensile strength of the cokes studied.

Acknowledgements

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References

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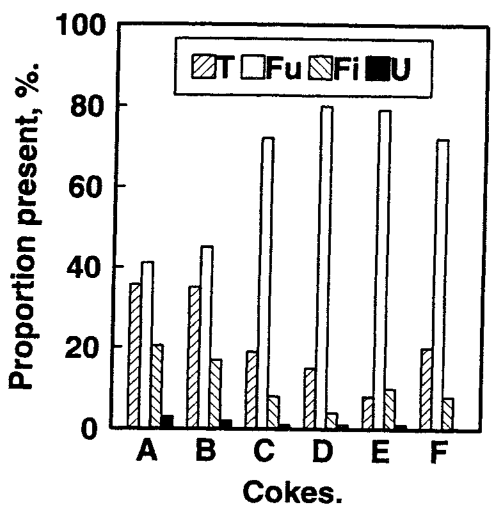

Fig. 1. Interface type distributions for the six cokes studied.

TABLE 1. Data for coals and cokes studied

Coal	Class	Total dilatation %	Tensile strength	Q
A	344	85	4.9	4.4
B	434	98	6.1	4.8
C	435	241	6.3	12.5
D	635	285	6.6	19.2
E	634	188	5.8	7.5
F	733	73	4.4	14.0

TABLE 2. Interface classification system

Interface type	Appearance
Transitional	A material, intermediate in appearance between the two textural components, is present at the interface.
Fused	The interface is clearly defined but bonding between components appears flawless.
Fissured	Fissures, small in comparison to the length of the boundary, are present at the interface.
Unfused	A gap is evident at the interface between two components indicating that no fusion had taken place.

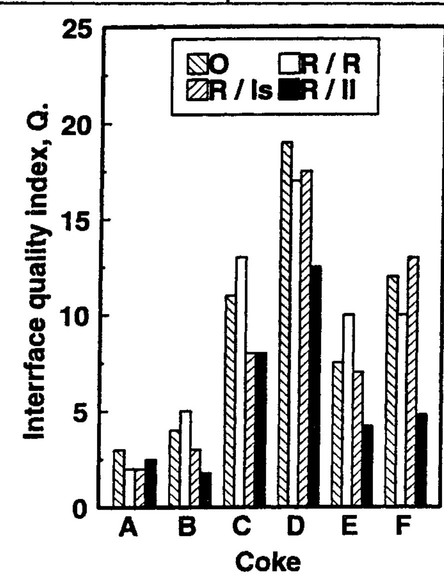

Fig. 2. Comparison of overall interface quality indices with those for reactive/reactive and reactive/inert interfaces.