

Image Analysis of Optical Texture in Coke

A fully automatic method for image analysis of optical texture of cokes has been developed. Digital images are analysed using customized computer software. The method

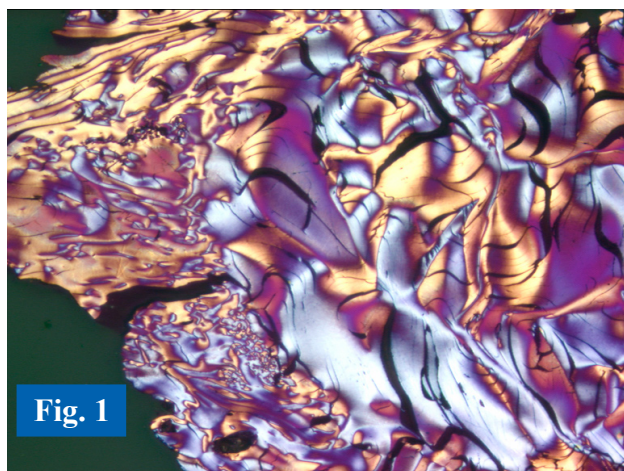


Fig. 1

outputs mosaic index, which is a measure of optical domain size; and fiber index, which is a measure of optical domain anisotropy.

Coke is screened to a narrow fraction size of 0.5-0.6 mm and the grains are embedded in epoxy. The samples are then polished and viewed with crossed polarising filters on a reflecting light metallurgical microscope. The birefractance of coke gives interference colours depending on the local direction of the graphitic layers.

Fig. 1 shows a coke image in polarized light. Connected areas with the same graphite layer direction (and same interference colour) are called optical domains.

Because the optical domains rarely appear as closed objects, the analysis method is based on measurement of the gradient lines between domains instead of measuring the domains as objects. The gradients are detected using a filter, thresholded and thinned to one pixel width. Fig. 2 shows the three steps in this process.

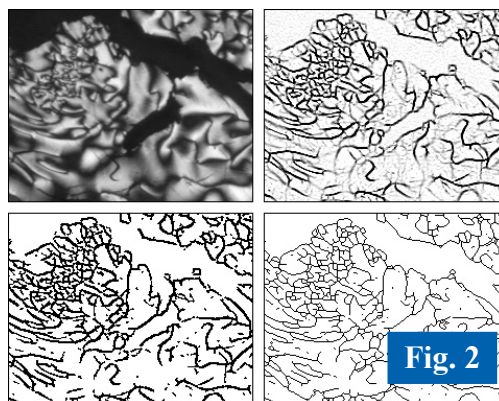


Fig. 2

The analysis is done in two steps: First, an overview image (Fig. 3) is assembled using low magnification. Then, the microscope stage is automatically moved by the computer to each grain position, where an image is captured and analyzed (Fig. 4).

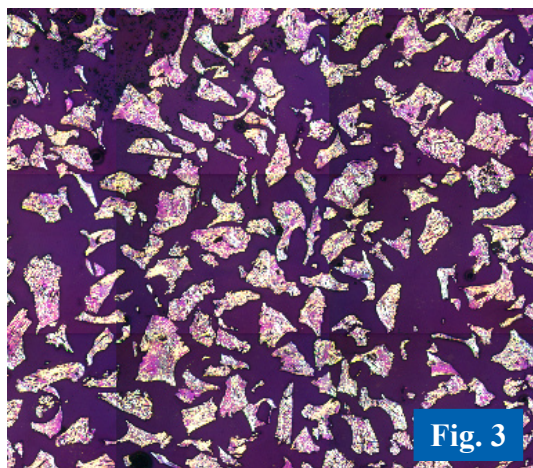


Fig. 3

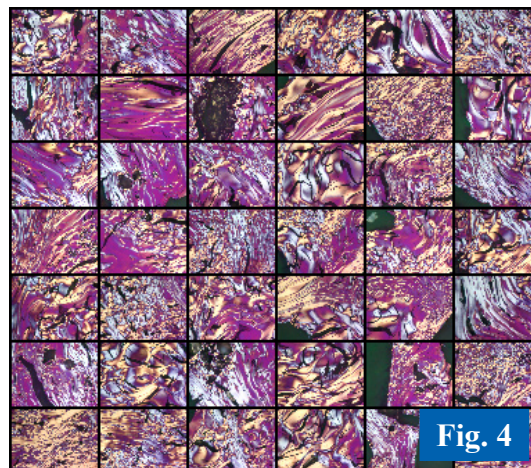


Fig. 4



Results

A dataset of two properties is output from the analysis:

1. Mosaic Index, which is a measure of the density of the mosaic texture. An isotropic coke gives a high number, while a coarse coke gives a low mosaic index.
2. Fiber Index, which is a measure of the degree of directionness in the texture. An anisotropic fibrous coke will get a high fiber index value, while a mosaic coke will get a low value.

These two properties can be plotted several ways. A useful way that will show the reproducibility of the measurement is to plot the average values of the mosaic and the fiber indexes as a function of grains.

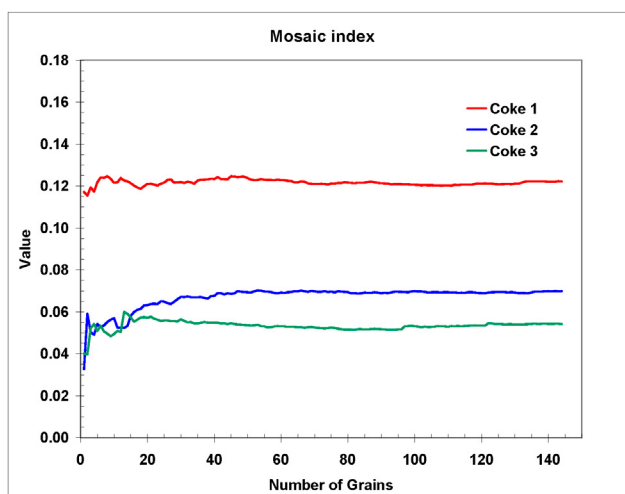


Fig. 5 Plot of the average values of mosaic index as function of number of grains analyzed. The convergence of the values shows the reproducibility of the samples.

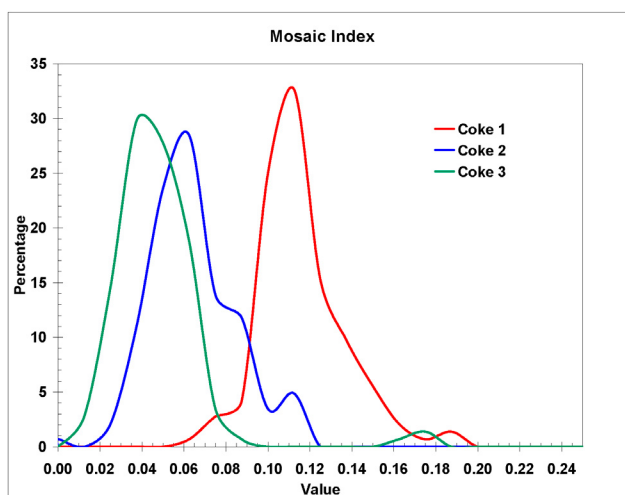


Fig. 6 Plot of the relative distribution of values. A narrow distribution means that the coke is homogenous.

Reference

S. Rørvik, M. Aanvik, M. Sørli, H.A. Øye, "Characterization of Optical texture in Cokes by Image Analysis", Light Metals 2000, 549-554.

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