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Automatic characterisation of chars from the combustion of pulverised coals using machine vision

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**Abstract** The study of char morphology, produced during combustion of pulverised coal, may be used to evaluate the effect of coal on the performance of the burner. Particle reactivity is the response to temperature and oxygen concentration and depends on particle size and other variations during the combustion. In this paper, we automatically characterised chars from the combustion of pulverised coal using machine vision. We have followed two different approaches to describe the chars: (i) its morphology and (ii) its intensity distribution provided by texture features. We realised that each of the binary layers obtained after bit-plane slicing a char image returned different representations that highlighted either rough or fine details. Hence we combined this finding with the two previous characterisation approaches. Thus, in this paper, we described char images using both morphology and texture computed on some specific bit-plane slices, and later on, we automatically classify each particle based on its description as having high, medium or low reactivity. To validate experimentally the proposed method we used char images from coals of three Colombian regions: Valle, Antioquia and Cundinamarca. We determined the reactivity of a coal sample by calculating the percentage of particles assigned to each of the three previous reactivity groups. The method that we are proposing obtains similar precision to the obtained by the manual analysis of char morphology following the International Committee for Coal and Organic Petrology criteria, but with the advantages of analysing the particles reactivity automatically.

**Keyword** Char morphology, coal combustion, coal reactivity, image processing, machine vision

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