Automated mineralogical analysis of coal dust $PM_{2.5}$ and PM_{10}

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A new method for the rapid mineralogical analysis of coal dust PM_{10} and $PM_{2.5}$, has been developed using QEMSCAN® automated mineralogical assessment on a Field Emission Scanning Electron Microscope. All previous attempts to characterise respirable coal dust samples using QEMSCAN® were unsuccessful, however this is now possible through major improvements in sample preparation techniques and the hardware platform. This research forms part of the EC-funded ROCD project (No 754205) which aims to address concerns about the health impacts of dusts in coal mines (see www.exeter.ac.uk/csm/rocd).

Success of the new method is largely due to the use of a low average atomic number sample substrate which allows coal particles to be distinguished from the background in backscattered electron images. For each sample, 100,000 particles are analysed, each at a 0.5μm spacing to define their mineralogy and to determine their size and shape characteristics. Accuracy is being checked by manual reanalysis of random particles and the use of particle size standards, precision by the analysis of replicate samples. Initial studies of PM_{10} and $PM_{2.5}$ samples from a Slovenian lignite mine (size separated post collection) have indicated that $PM_{2.5}$ consistently contains a higher proportion of non-quartz silicates, spherical particles of fly-ash (used to backfill mine support structures) and carbonate (locally spread to suppress dust). Comparative studies are being carried out on PM_{10} and $PM_{2.5}$ from a range of underground coking and steam coal mines in Poland.