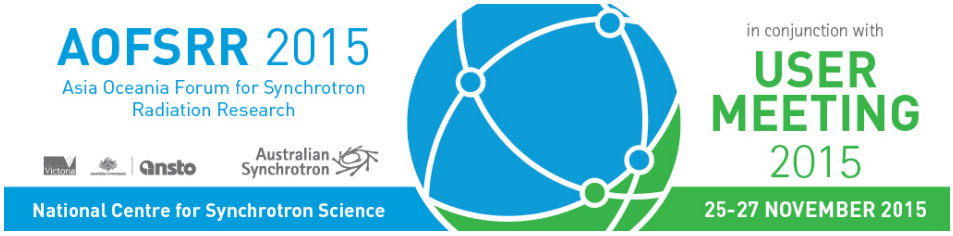

Contribution ID : **56** Type : **Poster**

Using the Synchrotron IR beam to develop optical markers for the characterisation of coal and other components in urban dust samples

Thursday, 26 November 2015 13:30 (45)

Establishing health impacts of urban dust require quantitative particle size and composition information. For the coal industry, dust is a significant responsibility. Coal dust originates from mining, transportation and coal usage. Public concern is greatest where mines are in proximity to towns, rail corridors and ports. Although coal may only be one of the dust constituents, there is an (often incorrect) perception that all black dust is coal; it is therefore important to to present dust analysis information in a way which can obtain acceptance.

We used the Australian Synchrotron Infrared Microscopy beamline to obtain chemical information for particulates including coal, diesel soot, rubber, organic matter, plastic, paint, rust, dirt and determined their proportions in urban dust samples collected in the coal transport corridor and coal ports.

The high spatial resolution of the Synchrotron IRM is ideally suited for the particles of interest which are in the 1-10 micron range. The Synchrotron is particularly useful to identify matter (e.g. organic) that is otherwise difficult to characterise. Sample spectra were recorded at the beamline microscope in Attenuated Total Reflection mode which allows enhanced spatial resolution due to the high refractive index of the ATR crystal element.

Once the particles are identified we use them used as a ground-truth to train a supervised learning algorithm that will allow identification of dust components based on optical microscopy. The optical images also provide the size information of individual particles and a method for presenting quantitative information on the makeup of dust.

Keywords

synchrotron IR, urban dust, coal mining, environmental issues, machine learning

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Session Classification : Poster Session 1

Track Classification : Earth and Environment