Particulate emissions from combustion of a coal+tire mixture

Reto Gieré[1], Katherine Smith[2], and Mark Blackford[2]

[1] Institut für Mineralogie, Petrologie und Geochemie, Universität Freiburg, D-79104 Freiburg, Germany (giere@uni-freiburg.de); [2] Materials Division, ANSTO, Menai, NSW 2234, Australia

KEYWORDS: coal+TDF, particulate matter, sulfates, zinc

ABSTRACT

The Purdue University power plant conducted an experiment with two different sets of fuel combusted at the same conditions (≈1500 ºC): pure coal and a mixture of 95 wt% coal plus 5 wt% tire-derived fuel (TDF). A detailed chemical comparison was made of both types of fuel, the combustion products, and the atmospheric emissions. Compared to pure coal (sub-bituminous coal from Southern Indiana), the coal+TDF mixture is considerably richer in Zn (183±42 *vs.* 36±16 ppm), and also has a higher S content (2.0±0.4 *vs.* 1.5±0.2 wt%). The increase in Zn is due to the high Zn content of the scrap tire chips (10936±849 ppm). Emissions of Zn increase from 55 g/h to almost 2.4 kg/h when coal+TDF was combusted.

Particulate matter was collected on filter paper (inserted into the top part of the smokestack) and characterized by scanning and transmission electron microscopy, and by electron microprobe. Amorphous material consists primarily of Al-Si-O glass spheres. Crystalline material comprises lime and mullite, and a variety of euhedral S-O phases (inferred to be sulfates), including sulfates of Ca, Pb, Fe-Zn (pure coal), and Zn (TDF+coal). The Zn and Fe-Zn sulfates range in size from a few nm to >100 □m. The large crystals must have formed only after the flue gas has passed through the air pollution control devices within the power plant.

Detailed characterization of these particles is essential to assess the interaction between crystals and atmospheric moisture or rain, and thus the environmental impact of tire combustion.

Submitted for consideration in the 2005 World of Coal Ash, April 11-15, 2005, Lexington, Kentucky, USA.