Nano-Scale Mineral Protection for Black Carbon Stabilization using Synchrotron-Coupled Transmission X-ray Microscopy for 3-D Tomography

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Black Carbon (BC) encompasses a variety of highly aromatic C forms including biochar, soot and graphite. Black C plays an important role in global warming and carbon cycling, and may act as a significant sink for green-house-gas CO_2 due to its long-term residence in the slower geological C pool. We explore high-resolution 3-D imaging using synchrotron-coupled Nano-Transmission X-ray Microscopy (TXM) and elemental mapping to describe the interplay of BC and mineral. Mineral particles of nano size are found in close association with both fresh and aged BC samples. Mineral of sheet layer is found important for the physical protection of BC. Our study provides the first direct description of BC physical protection by minerals, by far which is considered the most important mechanism for BC stabilization in environment.

Mercury Emission from Coal Fire and Spontaneously-ignited Gangue Hill and Distribution in Local Near-Surface Air in North China

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Underground coal fire is a global environmental and ecological hazard [1]. In China alone there are 84 coalfield in 13 provinces currently suffering from coal fire, with coal annual loss over 200 million tons. Coal gangue is a byproduct of coal mining and often piled up on site. There are estimated over 5,000 giant gangue hills located across China, with many of them reported spontaneous ignition [2]. These two source have no control or mitigation method of mercury emission, hence may bring mercury pollution on local environment and further contribute to global mercury inventory.

To study the mercury emission and diffusion pattern,a typical minig area with coal fire and gangue hill in Wuda coalfield, Inner Mongolia was chosen. Atmospheric mercury concentrations were measured at 1.2 m to ground surface by 10 m x 10 m grid in the prepheral area of fire zone and a giant gangue hill 6.7 km apart. Both results gave a prevalent mercury concentration of 40-50 ng/m^3, which is 30 times higher than the background level of atmospheric mercury (1.6 – 1.8 ng/m^3), and equal to previously reported atmospheric mercury concentration in the vicinity of mercury smelting factory [3]. The mercury concentraiton of ground vapor in a drilling hole -0.4 m to the surface in the vicinity of the gangue hill also fell in this range. The consistency of mercury content in two areas suggests that the mercury content may be the consequence of long-term accumulation and diffusion of gaseous mercury from multisites and multitype sources in the mining area rather than directly from the source. In addition, few vegetation were found in the mining area, and surface vegetation restored in correlation with the distance from the minig area. The exact influence range, the potential influence on remote populated area, and the potential impact on local vegetation of mercury emission from coal fire and spontaneous-ignited gangue hill still requires further insight.

[1] Stracher (2004) *Int. J. Coal Geol.* 59, 1-6. [2] Zhao *et al.*. (2008) *Int. J. Coal Geol.* 73, 52-62. [3] Li *et al.*. (2008) *Eviron. Chem.* 27, 96-99.

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