Fluorine in Chinese coals and its health impact

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The health problems caused by fluorine released during coal combustion are more extensive than those caused by arsenic. More than 14 provinces and more than 30 million people in China suffer from various forms of fluorosis, and about 15 million people have been diagnosed as having fluorosis. More specifically, around 10 million people in Guizhou Province and surrounding areas suffer from various forms of fluorosis. In Beimen Zheng and Hua Chun in Guizhou, about 78 % of the inhabitants are diagnosed as having skeletal fluorosis including osteosclerosis. Almost every family in this district has members suffering from skeletal fluorosis with limited movement of the joints, and outward manifestations such as knock-knees, bow legs, and spinal curvature. In Xiaotang Zheng, Pengshui, Sichuan province, among 5633 residents, there are about 98% of the residents suffering from tooth enamel mottling (dental fluorosis).

The authors carried out a series of fluorosis surveys in Guizhou. In a survey of one elementary school, among 57 students, only one student was found to be free of dental fluorosis, while 99% of the student population was diagnosed as having dental fluorosis. During these surveys, the authors also found that the youngest patient was about 1 year old. Typical signs of fluorosis include mottling of tooth enamel (dental fluorosis) and various forms of skeletal fluorosis.

TEM investigation of the non-oxidative dissolution of galena (PbS) nanoparticles in a hydrochloric acid solution

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Galena (PbS) is one of the most common base metal sulfide minerals in nature. The dissolution of galena in acid solution can be an important reaction controlling the transport and transformation of Pb in natural waters. Moreover, sulfide nanocrystals have been found in the natural environment as a result of bacterial metabolism (Labrenz *et al.*, 2000) or the breakdown of sulfides and silicates (Hochella *et al*., 2005) which has sparked an intense interest in understanding the dissolution mechanism of sulfide nanocrystals. Chemical properties of crystalline materials are known to be dramatically influenced by crystal size, especially for dimensions of 100 nm or less (Alivisatos, 1996). Nevertheless, much is still unknown about the size-dependence of dissolution. As a result, we are studying the structure and dissolution of galena nanocrystals. This work not only is important for understanding the effects of mineral size on geochemical processes, it also has implications for environmental remediation and the impact of nanotechnology on the environment.

Bright-field TEM and HRTEM have been applied to investigate the morphology and structural characteristics of galena nanoparticles. Galena nanoparticles ~15 nm in diameter were synthesized via variations on a wet chemical method reported by Joo *et al*. (2003). HRTEM images of the galena nanoparticles exhibit lattice patterns, demonstrating their highly crystalline nature. The nanoparticles aligned along two principal lattice directions, [100] and [110], have been studied most carefully. {100}, {110}, and {111} faces are presented on nanoparticles and {100} faces are more developed than {110} faces, resulting in a truncated cubic shape. By comparing the bright-field TEM and HRTEM images of pre- and post-dissolution nanoparticles, the dissolution rate can be determined by calculating the size change versus time. Shape and structure evolution can also be observed, which will provide important information for understanding the dissolution mechanism.

References

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