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Experimental research on the effect of mineral carbonation on dissolution of sphalerite in simulated waste rock

KAN KOTEGAWA[1], CHIHARU TOKORO[2] AND YUTARO TAKAYA[1]

[1]The University of Tokyo
[2]Waseda University
Presenting Author: kotegawa@g.ecc.u-tokyo.ac.jp

Acid mine drainage (AMD) generated in active and abandoned mines can have a significant impact on the surrounding environment, and it is necessary to reduce those impact through appropriate measures. Blending limestone with waste rocks containing sulfide minerals has been proposed as one of the effective source control measures to prevent generation of AMD [1]. The alkalinity of limestone is expected to increase pH of AMD, resulting in the precipitation of heavy metals and the decrease in dissolution rate of sulfide minerals, and oxidative dissolution of them will be prevented by formation of silicate and iron oxyhydroxide passivation layers on the surface of sulfide minerals. Since carbonates of Ca and Mg generated by mineral carbonation, which is a process to fix CO_2 in the form of stable carbonate minerals, have a similar effect to limestone and passivating layers generally form on feedstock grains in this process [2], mineral carbonation of mine wastes will be effective in AMD source control as well as in CO_2 sequestration. In order to investigate the effect of mineral carbonation on prevention of AMD generation, we conducted carbonation experiments and serial batch extractions using simulated waste rock sample consisting of basalt and sphalerite.

Basalt and sphalerite powder samples were blended and used in CO_2-water-rock interaction experiments at temperature of 25 °C and liquid-to-solid ratio of 5: ones with CO_2 pressurization and the others without it. Subsequently, the samples were dried in room temperature and each residue was used in serial batch extractions. For the first few batches, Zn leached from the samples with CO_2 pressurization was less than that from the samples without CO_2 pressurization. In addition, more Ca and Mg were leached from the samples with CO_2 pressurization throughout the experiment, suggesting that dissolution of carbonate minerals generated by mineral carbonation continues over a long period of time. These results indicate that mineral carbonation of mine wastes is an effective source control measure of AMD.

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