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Demonstration of the effect of heavy metal elution suppression by mineral carbonation treatment of mine tailings

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If the tailings from mines are not properly managed, they will react with oxygen and water in the air to produce acid mine drainage (AMD) that contains a large amount of heavy metal elements. The treatment of such AMD is expensive process, and it can continue for a long time even after the mine has been closed, so it is necessary to establish measures to prevent the generation of AMD as a fundamental countermeasure.

We are investigating measures to suppress the generation of AMD by mineral carbonation treatment of mine tailings. In the mineral carbonation process, Ca and Mg silicate minerals contained in mine tailings react with CO_2 to produce carbonate minerals. It is expected that this will have a pH buffer effect due to the dissolution of carbonate minerals when reacting with rainwater and that dissolved heavy metal elements will be re-precipitated as carbonate minerals. In this study, to demonstrate this concept, we used simulated mine tailings and actual mine tailings to carry out the mineral carbonation treatment. We then conducted a heavy metal elution serial batch test to verify the effect of the mineral carbonation treatment. In the case of using simulated tailings, the amount of heavy metal elution was significantly reduced in samples that had undergone a 7-day mineral carbonation treatment compared to samples without the treatment. This may be due to the dissolution of secondary minerals such as Mg and Ca carbonate continued for a long time, and the elements such as Pb and Zn re-precipitating due to the high pH maintained in the system. In addition, although the treatment period was shortened to 1 day for the actual mine tailings sample, a stronger heavy metal element dissolution prevention effect was observed than for the simulated sample. In the presentation, we will also discuss the mechanism by which such effects occur and consider the challenges for practical application.

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