Nano-scale observations of Cr-bearing spinel synthesized under low temperature hydrothermal conditions

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Chromite, the most common host mineral of chromium, generally crystallizes under high-temperature magmatic conditions. Chromite is occasionally found in 3.2 Ga Banded Iron Formations in Moodies group, Barberton Greenstone Belt, associated with overgrowth of magnetite. Whereas the occurrence suggests that chromite may have been formed in a hydrothermal system, chromite formation from an aqueous phase has not been rarely considered except only one research [1]. Therefore, we experimentally investigated chromite formation using a flow-through reactor to understand the formation processes of chromite under hydrothermal conditions.

Iron–chromium hydroxide ($(Fe,Cr)(OH)_3$) was prepared by mixing sodium chromate and ferrous chloride solutions at room tempreature as a starting material. The starting material was then reacted with ferrous iron dissolved by nitric acid at 150°C and 5 MPa for one week. Results of XRD analysis and FE-SEM observation show that the starting material is ferrihydrite with a small amount of goethite, both of which contain chromium. XRD spectra of the run products shows peaks for goethite and a spinel group minenal. 57Fe Mössbauer spectra of the run products shows the peak for ferrihydrite and goethite. The long persistence of ferrihydrite was likely due to the increased stability of ferrihydrite by incroporation of chromium into its crystal structure [2]. Needle-like or angular particles were observed on the surface of starting material by FE-SEM observatin. TEM observation with EDS analysis revealed the presence of polycrystals composed of low crystalline particles containing chromium in the run products. Their morphology and electron diffraction patterns were identical to that of spinel group minerals. These results demonstrated that chromium-bearing spinel may form under low temperature hydrothermal environment.

[1] Arai& Akizawa (2014) *Am. Min.* 99, 28-34. [2] Krehula& Music (2009) *J. Alloy. Comp.* 469, 336-342