

Synthesis of Symplectite (Fe₃(AsO₄)₂·8H₂O)

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Symplectite is the crystalline-triclinic ferrous arsenate (Fe₃(AsO₄)₂·8H₂O). It has very low solubility at neutral to slightly alkaline pH (much lower than scorodite). Hence, symplectite could be a dominant compound for arsenic immobilization in suboxic environment, such as in co-precipitated tailings ponds. However, little is known about its synthesis, solubility and structure. The objectives of this work were to study the synthesis methods and to characterize the product using various techniques.

Fe(II) (FeSO₄·7H₂O, 60, 90 mM pH 2, adjusted by HNO₃) and As(V) (Na₂HAsO₄·7H₂O, 40, 70mM, pH 8.6) solutions ere prepared using deoxygenated DI-water in glovebox.

Different synthesis strategies were tested including raising the pH of pre-mixed Fe(II)-As(V) solutions to 4, 5, 6, 8 respectively (denoted as RMP), and mixing Fe(II) and As(V) solutions at fixed pH (4, 5, 6, 8) (denoted as TAP) to precipitate the precursor followed by aging at different temperatures (21, 45, 70 °C). The molar ratio of Fe/As = 1.5 was applied. NaOH (0.25N) and HNO₃ (0.5N) were used to adjust media pH. The solid products were separated by filtration in glovebox and vacuum dried. XRD and SEM were used to characterize the products.

The XRD data indicated the successful synthesis of symplectite. SEM showed that the product was needle-shaped particles. The TAP method is better than RMP for the synthesis of symplectite. The media pH and temperature for precursor precipitation or crystallization during ageing are very important factors. Better crystallinity was obtained at higher temperature. The pH significantly influences the product's purity and re-crystallization. The rate of re-crystallization increased with increasing pH, but the highest pH of 8 was applied to avoid the formation of Fe(OH)₂.

[1] R.B. Johoston. Solubility of symplectite (ferrous arsenate):Implication for reduced groundwaters and other geochemical environments. Soil Sci. Soc. Am. 2007, 71:101-107.

In-situ trace elements and Li, Sr isotopes in peridotite xenoliths from Kuandian, North China Craton: Insights into Pacific slab subduction- related mantle modification

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Trace element, Li and Sr isotopic compositions of major minerals in peridotite xenoliths from Kuandian, North China Craton (NCC) were analyzed *in situ* to investigate Pacific slab subduction-related mantle modification beneath the eastern NCC. The ⁸⁷Sr/⁸⁶Sr ratios are positively correlated with the La/Nb, Ce/Zr and Sr/Y ratios and negatively correlated with the Nb/U ratio for Cpx. Based on the trace element distribution patterns, three types of Cpx were identified. Type 1 Cpx are characterized by significant Nb-Ta-Ti depletions and the highest Sr isotopic ratios; Type 2 Cpx display Nb (or Ta) depletions and highly variable Nb and Ta fractionation; and Type 3 Cpx show no significant Nb or Ta depletion or even weak Ta enrichment and have the lowest Sr isotopic ratios. Some Cpx display a pattern of increasing Ca+Mg±Si from the cores to the rims, indicating addition of Ca+Mg±Si-rich fluids derived from a serpentinized peridotite layer above the subducting slab. These features indicate multiple mantle metasomatism events associated with the ancient subduction of the altered Pacific oceanic crust, which may contribute substantially to the destruction of the eastern NCC.

The Li contents in the Cpx (up to 34.8 ppm) and Opx (up to 28.0 ppm) are typically higher than those in the coexisting Ol (< 9.19 ppm), suggesting silicate melt metasomatism. Furthermore, both pyroxenes and Ol display remarkable zoning patterns in their Li contents and isotopic ratios, indicating a redistribution and disequilibrium fractionation of Li within and/or between minerals. The Li enrichment and low δ⁷Li values in the rims of most Ol, Cpx and Opx may have arisen from diffusive fractionation during Li-rich melt/fluid metasomatic processes. However, the Li depletion and high δ⁷Li in the rims of a few Ol may suggest cooling-induced Li isotope fractionation. Based on the zonation and Li diffusion coefficient at mantle temperatures, a model calculation suggests that the latest Li-rich melt/fluid metasomatic process was a recent event occurring shortly before or during the host magma eruption.