American Mineralogist, Volume 109, pages 274–285, 2024

Raman spectroscopic investigation of selected natural uranyl sulfate minerals

Tyler L. Spano[1,*], Travis A. Olds[2,†], Marshall McDonnell[3], Robert Smith[3], and Ashley E. Shields[1]

[1]Nuclear Nonproliferation Division, Oak Ridge National Laboratory, 1 Bethel Valley Road, Oak Ridge, Tennessee 37831, U.S.A.
[2]Carnegie Museum of Natural History, 4400 Forbes Avenue, Pittsburgh, Pennsylvania 15213, U.S.A.
[3]Computer Science and Mathematics Division, Oak Ridge National Laboratory, 1 Bethel Valley Road, Oak Ridge, Tennessee 37831, U.S.A.

Abstract

Uranyl sulfates are important constituents of uranium ores and represent a significant fraction of U(VI) minerals discovered in recent years owing to their propensity to form in mine tailings and legacy sites related to uranium exploration. Recently, we surveyed all published Raman spectra for uranium minerals and found significantly less easily accessible data available for uranyl sulfates relative to other groups of uranium minerals (Spano et al. 2023). In that work, we described average spectra for groups of uranyl minerals to understand common vibrational spectroscopic features attributable to similarities in oxyanion chemistry among U(VI) minerals, but only data for three uranyl sulfate minerals were included in the study. The present work reports on Raman spectra collected for 18 additional uranyl sulfate minerals. To better understand underlying structural and chemical features that give rise to spectroscopic observables, we relate differences in structural topology, charge-balancing cations, and locality of origin to features observed in the Raman spectra of selected natural uranyl sulfates.

Keywords: Uranyl sulfates, Raman spectroscopy, U(VI) minerals