American Mineralogist, Volume 106, pages 105–111, 2021

Seaborgite, $LiNa_6K_2(UO_2)(SO_4)_5(SO_3OH)(H_2O)$, the first uranyl mineral containing lithium

Anthony R. Kampf[1,*], Travis A. Olds[2], Jakub Plášil[3], Joe Marty[4], Samuel N. Perry[5], Loretta Corcoran[5], and Peter C. Burns[5,6]

[1]Mineral Sciences Department, Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, California 90007, U.S.A.
[2]Section of Minerals and Earth Sciences, Carnegie Museum of Natural History, 4400 Forbes Avenue, Pittsburgh, Pennsylvania 15213, U.S.A.
[3]Institute of Physics ASCR, v.v.i., Na Slovance 1999/2, 18221 Prague 8, Czech Republic
[4]5199 East Silver Oak Road, Salt Lake City, Utah 84108, U.S.A.
[5]Department of Civil and Environmental Engineering and Earth Sciences, University of Notre Dame, Notre Dame, Indiana 46556, U.S.A.
[6]Department of Chemistry and Biochemistry, University of Notre Dame, Notre Dame, Indiana 46556, U.S.A.

Abstract

Seaborgite (IMA2019-087), $LiNa_6K_2(UO_2)(SO_4)_5(SO_3OH)(H_2O)$, is a new mineral species from the Blue Lizard mine, Red Canyon, San Juan County, Utah, U.S.A. It is a secondary phase found on gypsum in association with copiapite, ferrinatrite, ivsite, metavoltine, and römerite. Seaborgite occurs in sprays of light-yellow, long flattened prisms or blades, up to about 0.2 mm in length. Crystals are elongated on [100], flattened on {010}, and exhibit the forms {100}, {010}, {001}, and {101}. The mineral is transparent with vitreous luster and very pale-yellow streak. It exhibits bright lime-green fluorescence under a 405 nm laser. The Mohs hardness is ~2½. The mineral has brittle tenacity, curved or conchoidal fracture, and one good cleavage on {100}. The measured density is 2.97(2) g/cm^3. The mineral is immediately soluble in H_2O at room temperature. The mineral is optically biaxial (–), α = 1.505(2), β = 1.522(2), γ = 1.536(2) (white light); $2V_{meas}$ = 85(1)°; moderate $r < v$ dispersion; orientation $X \wedge \mathbf{a} \approx 10°$; pleochroic X colorless, Y and Z light green-yellow; $X < Y \approx Z$. EPMA and LA-ICP-MS analyses of seaborgite undermeasured its Li, K, and Na. The empirical formula using Li, Na, and K based on the structure refinement is $Li_{1.00}Na_{5.81}K_{2.19}(UO_2)(SO_4)_5(SO_3OH)(H_2O)$. Seaborgite is triclinic, $P\bar{1}$, a = 5.4511(4), b = 14.4870(12), c = 15.8735(15) Å, α = 76.295(5), β = 81.439(6), γ = 85.511(6)°, V = 1203.07(18) Å^3, and Z = 2. The structure (R_1 = 0.0377 for 1935 $I > 2\sigma I$) contains $[(UO_2)_2(SO_4)_8]^{4-}$ uranyl-sulfate clusters that are linked into a band by bridging LiO_4 tetrahedra. The bands are linked through peripheral SO_4 tetrahedra forming a thick heteropolyhedral layer. Channels within the layers contain a K site, while an additional K site, six Na sites, and an SO_3OH group occupy the space between the heteropolyhedral layers.

Keywords*:* Seaborgite, new mineral species, lithium, uranyl sulfate, crystal structure, Blue Lizard mine, Red Canyon, Utah