

Cs₂K(UO)₂Si₄O₁₂: A Mixed-valence Uranium(IV, V) Silicate

Cheng-Shiuan Lee (李承軒)¹, Sue-Lein Wang (王素蘭)¹, and Kwang-Hwa Lii (李光華)^{2,3}

¹Department of Chemistry, National Tsing Hua University, Hsinchu, Taiwan

²Department of Chemistry, National Central University, Chungli, Taiwan

³Institute of Chemistry, Academia Sinica, Taipei, Taiwan

To further establish the valence state of the uranium in Cs₂K(UO)₂Si₄O₁₂ (**1**), X-ray absorption near-edge structure (XANES) spectra were recorded at a wiggler BL01C1 beamline of the National Synchrotron Radiation Research Center, Taiwan, in transmission mode at 293 K. The U L₃-edge XANES spectra of compound **1** and three reference materials, U^{IV}O₂, K₃(U^V₃O₆)(Si₂O₇) and U^{VI}O₃, are shown in Fig. 1. The U^{VI} edge, measured at the position of the half-edge step marked by a horizontal dashed line in the figure, is at 17169.4 eV, which is 0.7 eV above the U^V edge at 17168.7 eV, and 3.2 eV above the U^{IV} edge at 17166.2 eV. The edge of **1** is at 17167.1 eV, a value which is consistent with the presence of U^{IV}/U^V in this material.

Therefore, the electroneutrality principle, polyhedral geometry, bond-valence sum, XPS, and XANES spectroscopy indicate that **1** is a mixed-valence U^{IV}/U^V oxide material.

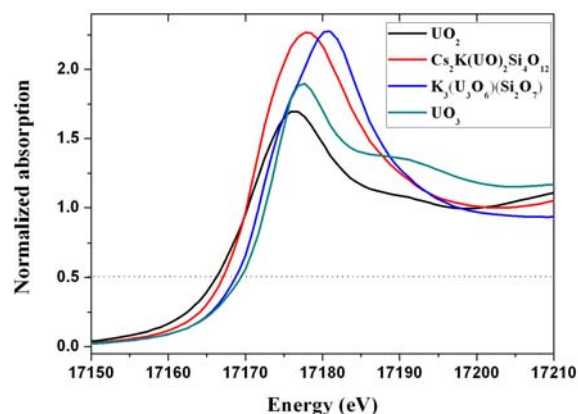


Fig. 1: The U L₃-edge XANES spectra of **1**, along with three standards, U^{IV}O₂, K₃(U^V₃O₆)(Si₂O₇), and U^{VI}O₃. The dashed line at the absorption coefficient value of 0.5 is included to elucidate the chemical shift.

Reference

- [1] C.-S. Lee, S.-L. Wang, and K.-H. Lii, J. Am. Chem. Soc. **131**, 15116 (2009).