

Redox states of uranium in samples of microlite and monazite

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ABSTRACT

By applying the method of chemical shifts of the uranium $L\alpha_1$ and $L\beta_1$ X-ray emission lines, the oxidation state of U has been determined in select samples of microlite and monazite. From the relative contents of U^{4+} , U^{5+} , and U^{6+} species, the oxygen coefficients have been calculated as a characteristic of U-oxidation rate. It is shown that the oxidation state of U is higher in the studied microlite than in monazite. Possible mechanisms of U oxidation in these two types of minerals are discussed, and it appears that the crystal structure of monazite plays an important role in stabilizing the U redox state. Spontaneous purification of the monazite structure from alien atoms, including U, may be possible via recrystallization of the α -recoil tracks. An explanation is suggested for intensive U oxidation in microlite and in other minerals of the pyrochlore group.

Keywords: Microlite, monazite, oxidation states of uranium, chemical shifts of X-ray lines, metamict state, spontaneous recrystallization