

## Mechanical and structural properties of radiation-damaged allanite-(Ce)

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Natural actinide containing minerals have found to be suitable model substances to study the long-term effects of nuclear radiation on ceramics [1]. However, the mechanical properties of such minerals have been rarely studied so far. We present the results of annealing experiments of radiation damaged allanite-(Ce) containing ThO<sub>2</sub>. The term allanite describes a subgroup of the epidote mineral group with the ideal composition Ca<sub>2</sub>REEAl<sub>2</sub>Fe<sup>2+</sup>[SiO<sub>4</sub>][Si<sub>2</sub>O<sub>7</sub>]O(OH) [2]. The onset of the thermally induced recrystallization could be revealed to occur already below 600 K by synchrotron XRD and DSC/TG measurements. The elastic modulus and hardness, determined by nanoindentation, have found to be sensitive indicators for the overall reorganization process. Structural OH groups seem to amplify the recrystallization process as already expected in literature [3]. TEM revealed an amorphous matrix surrounding small preserved crystalline domains in the pristine allanite samples. Using Mössbauer spectroscopy the oxidation of the incorporated iron has been followed that is accompanied by H loss.

[1] Ewing, Chakoumakos, Lumpkin, Murakami, Greegor & Lytle (1988) *Nuc Instr Met Phy Res B* 32, 487–497. [2] Bonazzi, Holtstam, Bindi, Nysten & Capitani (2009) *Am Mineral* 94:121–134. [3] Zhang, Salje, Malcherek, Bismayer & Groat (2000) *Can Mineral* 38:119–130.