Thermal behavior of new mineral belomarinaite ($KNaSO_4$)

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Belomarinaite, ideally $KNaSO_4$, is a new sulphate mineral. Belomarinaite was discovered on the Toludskoe lava field which was formed during Tolbachik Fissure eruption in 2012–2013. For the first time, the thermal behavior of a new mineral belomarinaite $KNaSO_4$ [Filatov et al., 2017] was studied on a natural sample and its synthetic analogue in the range of 30-800 °C. High-temperature X-ray diffraction studies were conducted using a Rigaku Ultima IV diffractometer equipped with a high-temperature accessory, $Cu_{k\alpha}$, radiation, the temperature was varied from 25 °C to a 800 °C, the temperature step was 10 °C.

The mineral is stable up to a temperature of 475 ± 10 °C, at which it has a polymorphic transformation into a high-temperature polymorphic modification ($P6_3/mmc$), stable up to 800 °C (Fig. 1). The thermal expansion of both modifications is sharply anisotropic, and in the case of the high-temperature phase it is also variable as a function of temperature - the dependence of the parameter *a* has a U-shape with a minimum at *t* = 660 °C. The volumetric expansion of modifications varies in the intervals of their existence for the low-temperature phase from 80 to 200 (10^{-6} °C^{-1}), for the high-temperature phase, from 350 to 300 (10^{-6} °C^{-1}). That is, on average, the expansion of the high-temperature modification increases by a factor of 2-3 relative to the expansion of the low-temperature phase, the main increase is in the parameter *c* and is determined, apparently, by restructuring the structure along this direction.

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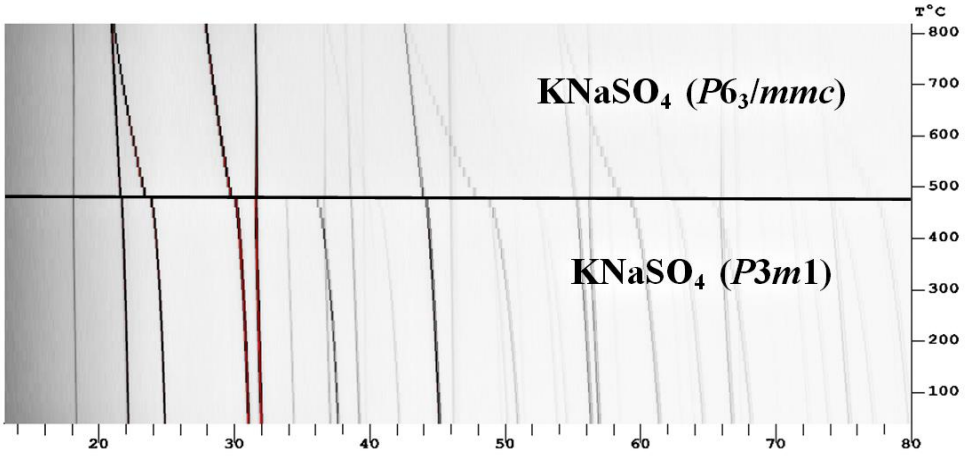

Fig. 1. Thermal phase transformation upon cooling in a belomarinaite. The horizontal line indicates the phase transition temperature.

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