Synthesis of Polycrystalline Mixed System $Rb_{3-x}K_xCu_3AlO_2(SO_4)_4$

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The mineral alumoklyuchevskite ($K_3Cu_3(Fe,Al)O_2(SO_4)_4$)was for the first time characterized in the year 1992. The crystal structure consists of oxocentered $[O_2Cu_3Al]^{5+}$ tetrahedra that form elongated chains in b-directions [1]. Along these chains magnetic monomers and magnetic dimers form on the Cu atoms [2]. For magnetic investigations alumoklyuchevskite is interesting, because it is a possible candidate for a spin liquid, which makes it important for fundamental research in the field of 1-D magnetism and absence of magnetic ordering [2]. The aim of our research is to synthesize Rb substituted alumoklyuchevskite with different Rb:K ratios, and to investigate the resulting effects on crystal structure and magnetic properties.
In our experiments the synthesis of polycrystalline alumoklyuchevskite was achieved by tempering of a mixture of starting chemicals: Rb_2SO_4, CuO, $CuSO_4$ $5H_2O$ and $AlK(SO_4)_2$ $12H_2O$. For example, it was discovered that for the 2Rb:K phase the optimum synthesis conditions are between 550°C and 600°C.

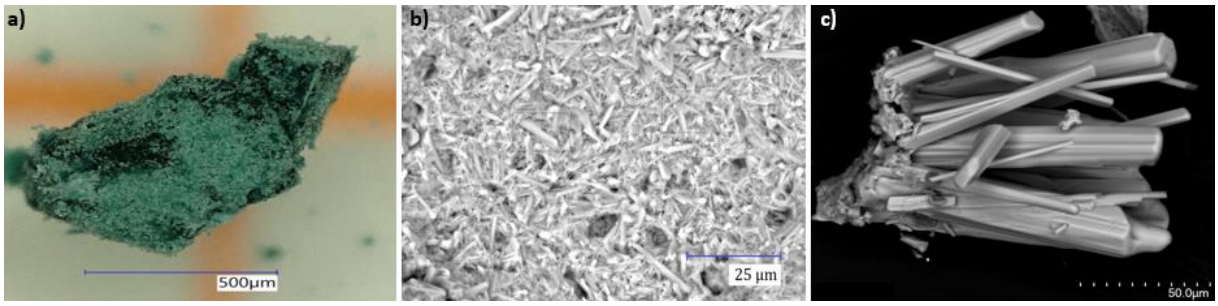

Figure 1: a) Optical image from polycrystalline Rb substituted alumoklyuchevskite b) Back scattered electron microscope (BSE) -image of Rb-substituted alumoklyuchevskite with crystals that have a maximum size of 15 µm c) BSE image of fedotovite crystals growing on dolerophanite

Deviations from the synthesis stability field of alumoklyuchevskite result in the growth of an additional "green" phase. First results suggest that the "green" phase is Rb-substituted fedotovite, which would be a new finding. First results suggest a two-stage formation of fedotovite from $CuSO_4$ and from the intermediate phase dolerophanite. Figure 1a) presents an optical magnification of the Rb substituted alumoklyuchevskite phase, which displays single grains and some facets. The same phase investigated with electron microscopy is shown in Figure 1b). Figure 1c), shows an electron microscope image of Rb substituted fedotovite. First magnetic susceptibility measurements align with previous finding and show that Rb substitution changes the magnetic exchange interaction of the magnetic dimers and magnetic monomers in the alumoklyuchevskite.

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