[MS18-P08] Niobium rich chevkinite-(Ce) – structural investigations.

Marcin Stachowicz,[a] Krzysztof Wozniak,[b] Boguslaw Baginski,[c] Ray Macdonald,[c]

[a]*College of Inter-Faculty Individual Studies in Mathematics and Natural Sciences, University of Warsaw, Poland,*
[b]*Chemistry Department, University of Warsaw, Poland,*
[c]*Geology Department, University of Warsaw, Poland*
E-mail: marcin.stachowicz@chem.uw.edu.pl

The minerals belonging to the chevkinite group (CGM) are recognised as accessory phases in a wide range of igneous and metamorphic rocks [1, 2]. The geochemical importance of this group is associated with a high REE-concentration; the total REE_2O_3 contents are up to 50 wt%. They can be the dominant REE-bearing phases in any given rock. The REE are increasingly used in green technologies, such as the production of novel wind turbines, low-energy light bulbs also mobile phones. Additionally neodymium, one of the most common REE, is a key part of neodymium-iron-boron magnets used in hyperefficient motors and generators [3].

We will present the results of electron microprobe analyses and structural determination of a Nb-bearing mineral from Biraya, Russia, which has the Nb2O5 content of 10.19 wt.% and the Ti/Nb ratio of 1.1:1. A special attention in the study has been paid to the role of Nb and its valency in the structure. The refinement of X-ray data based on microprobe analysis leads to the following formula for this phase: (Ce2La1.25Nd0.4Pr0.2Na0.15)(Fe0.7Ca0.15Sr0.15)(Fe1.3Mg0.15Nb0.55)(Ti1.2Nb0.55Al0.15V0.1) Si4O22. In order to determine which atoms occupy particular sites, the Bond Valence (BV) Model [4], together with an analysis of the ionic radii and volumes at each site within the first coordination sphere polyhedra, was used. There is some uncertainty in the literature as to which space group (or groups) does CGM belong to. P21/a was favoured in some publications ([5],[6],[7]), whereas in the other ones ([8],[9],[10], [11]) the C2/m space group was prefered. On the basis of our new structural data for niobian chevkinite-(Ce), one can rationalise a possible relationship between the P21/a and C2/m space groups. The same single crystal which was investigated using X-ray radiation was annealed at 750oC for 24 hours, and then rapidly cooled to room temperature (within 1 hour). After this process, we collected the X-ray scattering data on our single crystal X-ray diffractometer. The analysis of the reconstructed reciprocal lattice layers indicates a significant decrease of symmetry for the niobian chevkinite-(Ce) from the C2/m to P21/a space group. The observed phase transition is in a good agreement with the group theory. The possibe space groups can be presented as the Bärnighausen tree [12]. This scheme is showing transition pathway from the supergroup (C2/m in this case) to one of the subgroups (P21/a). A possible explanation of the phase transition that occured for niobian chevkinite-(Ce) will be presented by authors.

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[MS18-P17] Laserinduced dynamic strain measurements in granular rocks and minerals

Rudolf Winter[a], Morgan E Jones[a], Stephen Fearn[a], Stephen Thompson[b], Chiu Tang[b], Ian Clark[c]

[a]*Materials Physics, Aberystwyth University, Aberystwyth SY23 3BZ, Wales;*
[b]*Beamline I11, Diamond Light Source, Didcot OX11 0DE, England;*
[c]*Central Laser Facility, STFC Rutherford Appleton Laboratory, Didcot OX11 0QX, England*

Dynamic strain applied in short impulses can affect materials drastically. In technological applications dynamic strain can be a result of switching processes such as switching on of a fuel cell or heat source cycling in a melt furnace. In the natural environment, dynamic strains travel through rocks as a result of tectonic events resulting in earth quakes and volcanic eruptions. In single crystals, strain impulses travel with the speed of sound of the material concerned. In granular materials, the limiting factor is the propagation of strain from one grain to another along a sequence of grain contact points. This makes the process several orders of magnitude slower. For the present experiment, we have selected polycrystalline quartz and cryptocrystalline flint as model samples to study the effect of grain size. Slate is used in comparison with quartz to investigate the effect of grain aspect ratio in silicatebased rocks, and marble (limestone) is contrasted with flint as finegrained representatives of silicate and carbonate based minerals.

In this experiment, we have simulated the effect of dynamic strain on these granular rocks by applying repeated nanosecond Nd:YAG laser pulses to a slice of rock while measuring the diffraction pattern at various displacements from the impact site. The laser and the Mythen positionsensitive detector on beamline I11 were jointly driven by a pulse generator to produce a repeatable time structure comprising a single shock followed by a 1ms diffraction exposure to provide maximum time resolution. Frames subject to dynamic strain have a distribution of lattice parameters resulting in a net broadening of each Bragg peak. Since a single exposure provides insufficient statistics to analyse peak broadening, a number of these 1ms exposures are added in a rolling average procedure. This approach balances acceptable statistics with the probability of capturing the strain wave as it travels through the beam. The average strain in each of these averaged exposures is determined using a Pawleyle Bail fit of the whole pattern in Topas software.

Initial results show that the largest strain is observed at a displacement of about 1mm from the impact site and that it disperses monotonically over a distance of about 8mm. Further analysis is currently in progress with the aim of understanding the effect of strain impulses on the different rock types studied.