## RAMAN SPECTROSCOPY OF N<sub>2</sub> IN NATURAL CORDIERITE AND BERYL SINGLE CRYSTALS

Haefeker, U.<sup>1</sup>, Kaindl, R.<sup>2</sup>, Tropper, P.<sup>1</sup> & Konzett, J.<sup>1</sup>

<sup>1</sup>Institute of Mineralogy and Petrography, University Innsbruck, Innrain 52, A-6020 Innsbruck, Austria
<sup>2</sup>MATERIALS – Institute for Surface Technologies and Photonics, Functional Surfaces, JOANNEUM RESEARCH Forschungsgesellschaft mbII, Leobner Straße 94, A-8712 Niklasdorf, Austria.
c-mail: udo.haefeker@uibk.ac.at

Natural Cordierite with the idealized composition  $(Mg,Fe)_2[Al_4Si_5O_{18}]*x(H_2O,CO_2)$  occurs mostly as the orthorhombic polymorph with an ordered Al/Si-distribution on the tetrahedral sites. The structure contains stacked six-membered rings of (Si,Al)O<sub>4</sub> forming channels parallel to the crystallographic *c*-axis. The rings are linked laterally and vertically by additional (Al,Si) tetrahedrons, octahedral sites contain mainly Mg and Fe<sup>2+</sup> Similarly, the structure of hexagonal beryl with  $Al_2Bc_3(Si_6O_{18})$  contains six-membered rings of SiO<sub>4</sub> stacked along c which are laterally linked by  $BeO_4$  tetrahedra, octahedral sites contain Al. Volatiles like  $H_2O$ ,  $CO_2$  and  $N_2$  can be incorporated into the structural channels of both minerals in various amounts. Natural cordierite single crystals with N<sub>2</sub> contents of 104 and 446 ppm (samples 129875 and H06, LAZZERI, 2012) as well as a beryl single crystal (from Texel complex, Italy) were investigated with micro Raman spectroscopy under ambient conditions. The  $N_2$  stretching vibration occurs at 2325 cm<sup>-1</sup> in cordierite and 2328 cm<sup>-1</sup> in beryl and is thus shifted towards lower energies in both minerals when compared to  $N_2$  gas. Polarized spectra show that the  $N_2$  molecules in cordicrite are incorporated perpendicular to the crystallographic c axis and are preferentially aligned parallel to a, which is consistent with former optical and X-ray diffraction studies (ARMBRUSTER, 1985). A plot of the N<sub>2</sub> Raman peak intensities vs. N<sub>2</sub> contents in ppm indicates a linear relationship in cordierite. Analogous to cordierite the  $N_2$  molecule in beryl is incorporated perpendicular to c.

LAZZERI, K. E. (2012): Lehigh University Thesis, Paper 1327. ARMBRUSTER, T. (1985): Physics and Chemistry of Minerals, 12, 233-245.