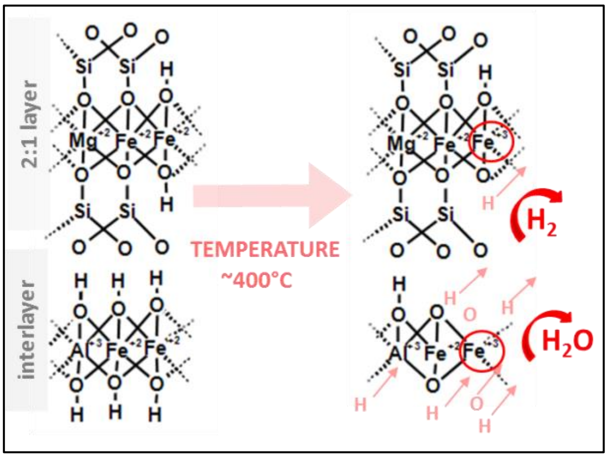
Chlorites are abundant minerals belonging to the phyllosilicate group. They occur in various environments form metamorphic, igneous to sedimentary rocks, or they are associated with alteration products of ferromagnesian minerals. Their structures are composed of a package of 2:1 layer - two silica tetrahedral sheets surrounding a sheet of octahedral (Mg, Fe^{2+}, Fe^{3+}, Al) and an additional octahedral (interlayer) sheet (called 2:1+1 sandwich structure). Due to these two octahedral sheets, chlorite has one of the highest OH group content (~13 wt.% of "structural water" equivalent) among hydrous phyllosilicate minerals. The determination of real amount of water transported by chlorites to metamorphic and magmatic system is an important information in the study of formation and degradation of rocks and minerals. Moreover, thermal decomposition reactions of the chlorites that control these processes, however, is still poorly understood. The project's results will help in understanding the order and mechanism of reactions involving thermal alteration of chlorites, which control a number of disciplines: ceramics, archeology, or formation of supergene ore.

During the heating of chlorite (~400°C), the structure undergoes decomposition involving the dehydroxylation reaction, which is associated with the formation and elimination of H_2O molecule from hydroxyl groups in octahedral sheets. However, thermal alteration of iron (II)-containing chlorites is more complex due to the dehydrogenation reaction involving a release of one hydrogen atom per one oxidized iron (II) atom. This reaction – oxidative dehydrogenation occurs in neutral conditions, without the incorporation of oxygen into the structure. The proposed scheme of simultaneous dehydroxylation and oxidative dehydrogenation model for Fe(II) chlorite is presented as follows.



The goal of the proposed project is to explain the mechanism of oxidative dehydrogenation and its relation to dehydroxylation for iron (II)-containing chlorites. The natural chlorites samples from a common Mg-Fe-series, differing by iron content will be tested. The order and the relationship of these two reactions is still unclear, hence the need for accurate thermal investigations. The factor of different chemical composition of chlorites, which influences the progress of this reaction and response to heating, will be studied. In addition to the progressive iron (II) oxidation, the oxidative dehydrogenation results in the decrease of the quantity of OH groups available for dehydroxylation. Therefore, this project aims at testing the usability of thermal methods for determination of water content (H_2O+) in iron (II) chlorite and other iron (II) phyllosilicates. The objectives of proposed research will be addressed through laboratory heating experiments in neutral and oxidizing conditions (thermogravimetry, diffuse reflectance infrared Fourier transform spectroscopy) and instrumental analysis (Mössbauer spectroscopy and X-ray diffraction) which allow tracking of the structural changes during thermal decomposition of chlorite.