

Atom probe tomography (APT) analysis of bulk chemistry in minerals

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Atom probe tomography (APT) analysis of materials is an established technique for atomic level compositional analysis. Extensive research has been performed on many alloys, compounds, multilayered thin films, integrated circuits, and even polymers. Some geological materials, mainly minerals and biominerals, have been previously studied, but the use of APT for precise, stoichiometrically correct, bulk chemistry analysis of minerals, remains insufficiently constrained. Often, the mass spectra from natural geological samples exhibit many complex ionic species, and their interpretation can lead to differing determinations of composition. The aim of this talk is to present ATP data from analyses performed on mineral standards of carbonates (calcite and dolomite) and sulfides (pyrite) and natural samples of silicates (i.e. garnet), sulfides, oxides (i.e. magnetite) to evaluate the current APT performance on determining the bulk atomic composition of minerals. Overall, our preliminary results indicate that a correct interpretation of APT data can be achieved by understanding the crystallo-chemical properties of minerals and using multiple methodologies to obtain mineral chemical data. For future studies involving the use of APT in minerals, the emphasis has to be placed on the need to establish standard operational procedures for sample preparation and analysis, and further development on the presently available data analysis software.