MS14-P03 | ELECTRON CRYSTALLOGRAPHY OF PLANETARY MATERIALS: IMPACTITES AND MICROMETEORITES

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Electron crystallography have evolved in the last years into a technique able to furnish fast and reliable structural information from nanocrystals. 3D electron diffraction (ED) methods provide diffraction data from nm-sized domains, which are suitable for ab-initio structure solution. Moreover, it is now possible to derive a phase and orientation map with nanometric resolution by recording a sequence of ED patterns while scanning an area. Therefore, we have access to the crystal structure and to the phase and topotactic relations between the crystalline grains at a scale of few nanometers at the same time.

Cutting-edge electron diffraction methods guarantee a new opportunity for understanding the kinetic and the thermodynamic history of a geological sample with a cryptocrystalline habit. We will show specific applications of this analysis to impact rocks shocked by a hypervelocity impacts of cometary and asteroidal bodies on Earth crust. The investigation at the nanoscale with ED methods shows evidence of coesite formation directly from quartz and not from a dense amorphous phase during shock unloading as previously thought.

A second field of application is the identification of nanocrystalline phases in micrometeorites. We show the determination of magnetite and pyroxene crystals in a hydrated chondritic micrometeorite (CP94-050-052). These phases have been determined with a 3D ED data collection with a 150 nm beam by diffracting only on the nanocrystalline grains of interest, avoiding any contribution by the surrounding matrix. This research was supported through Programma Nazionale delle Ricerche in Antartide (ID# PNRA16_00029).