



- MicroRaman and FTIR spectroscopy – enables the real-time in-situ characterization of **surfaces** in two dimensions.
- The combination of confocal microscopy and incorporation of an electrochemical cell can provide intrinsic information on **battery aging** and the dynamic nature of the **solid electrolyte interfaces** (mechanical and chemical changes in the electrode and the reactions of the electrolyte at the electrolyte/electrode interfaces) on real time cycling and at various voltammetries.



T. 16 Operando Raman and FTIR spectroscopy - CERTH



- Laser beam access on the electrode/electrolyte interface provides a high spatial resolution, high sensitivity and non-destructive in-situ characterization tool for the **mapping of chemical bonding at the electrodes' surface** as well as providing information on intermediate species in reactions and study phase changes at operando mode.
- The respective approach in combination with ex-situ Raman mapping measurements can identify the discharge products produced on cathodes and determine their distribution.

Applications

- Spatial distribution of phases with RAMAN mapping
- Effect of reaction conditions and doping
- Evaluation of the quality of material (e.g. graphene)
- Characterization and distribution of additives in the electrolyte

Specs:

Analysis at material or electrode level

Investigation time-scale: days

Non destructive technique

