Raman spectroscopy as a structural characterization tool for lithium iron phosphates

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Lithium iron phosphate $LiFePO_4$ (LFP) with olivine structure was proposed to be used as a positive electrode material for lithium batteries in 1997 [1]. Twenty one years later LFP-based cells are widely used in traction batteries (LFP is the dominating cathode material for electric buses batteries) and stationary energy storages systems for grid balancing and renewables. Maybe, partially due to such a fast transition from promising to industrial-scale-produced positive electrode material, LFP still needs in some basic researches. One of the most important in the times of fast production scaling-up and steady price per kW·h decreasing is the structural characterization.

Raman spectroscopy is rather popular methods of LFP structural characterization, but used mainly as supplementary tool for target composition confirmation or structural characterization of carbon coating/additive, applied due to poor electronic conductivity of LFP. Moreover, while LFP decomposition under the action of probing laser is well known fact [2, 3], there are still publications with Raman spectra of iron oxide (product of LFP decomposition) confused with LFP Raman spectra. In our work we, first, study the peculiarities of Raman spectroscopy study in atmospheres with two different oxygen content. Second, we use statistical Raman spectroscopy for structural characterization in terms of structural quality control.

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