Experimental report

03/09/2022

Proposal: 7-02-172 **Council:** 4/2017

Title: Temperature-dependence phonon measurements in single crystal FAPbI3 and FAPbBr3

Research area: Physics

This proposal is a continuation of 7-02-169

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Local contacts: Stephane RAYMOND

Samples: FAPbI3
FAPbBr3

Instrument	Requested days	Allocated days	From	To
IN12	7	4	09/04/2018	13/04/2018

Abstract:

During the past few years, hybrid organic perovskites (HOP) have been intensively studied as promising materials for not only photovoltaics, but optoelectronic applications in general. Currently, lead-halide based HOP of general formulae MPbX3 (X=I, Br, Cl; M=methylammonium (MA=MCH3NH3), or FA=formamidinium (FA = HC(NH2)2) are the most popular studied systems. As part of our project we aim to better study the dynamic and structural properties of hybrid perovskites, i.e. low-frequency phonons and relaxation molecular dynamics. In our most recent experiment on IN12 (26th-31st January 2017), we have measured acoustic phonon branches of the formamidinium-based iodine hybrid perovskite FAPbI3 and sound velocities have been estimated in most directions. This will allow for the comparison of the elastic constants between MAPbI3, MAPbBr3, FAPbBr3 and FAPbI3. However, it has been reported that these perovskite systems undergo a phase transition between 130 and 160K. We then ask for 7 days in total on the cold source triple axis spectrometer IN12 to study how the lattice dynamics of FAPbI3 and FAPbBr3 evolve across lower temperatures, especially at around 150K.

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The experiment 7-02-172 has been performed From 09/04/2018 To 13/04/2018. The phonon spectrum has been measured in FAPbBr3. The results have been published in Communications Physics in march 2020:

A. C. Ferreira, S. Paofai, A. Létoublon, J. Ollivier, S. Raymond, B. Hehlen, B. Rufflé, S. Cordier, C. Katan, J. Even & P. Bourges, Communications Physics 3, 48 (2020).

and can be found at https://www.nature.com/articles/s42005-020-0313-7.