Contribution ID: **21** Type: **Poster Presentation**

2D metal-halide perovskites for application as indirect radiation detectors: study of PEA2PbI4 and 4F-PEA2PbI4 polycrystalline films

Thursday, 20 July 2023 17:10 (20 minutes)

The development of high-performance, low-cost scintillators is an important area of research due to their wide application in medical imaging, homeland security, high-energy physics, industrial control, oil drilling explorations, and energy management.[1] The cost and inherent properties of traditional scintillators based on inorganic semiconductors, are their limitations. Low-temperature solution-based processes and high stopping power have shifted the attention on metal halide perovskite (HP). The superior photophysical and electronic properties of 2D-HPs, including large absorption coefficients, high photoluminescence yields, fast decay time and structural stability make them promising candidates for next-generation scintillator. This work aims to develop polycrystalline 2D-HPs for scintillators application with high detection power and fast scintillation response.[2]

Two different 2D-HPs, phenethylammonium lead iodide (PEA2PbI4) and 4Fluoro-phenethylammonium lead iodide (4F-PEA2PbI4,) have been investigated. In particular, different solvent mixtures were studied, and their effect was observed characterizing the different samples by studying their optical, crystalline and morphological properties as a function of the solvents used and the annealing time at fixed temperature (100 ℃).

Despite the irregular growth of 4F-PEA2PbI4, which resulted in a rough and inhomogeneous surface, if compared to PEA2PbI4, both 2D-HPs showed a strong and narrow photoluminescence (FWHM<25 nm) peaked at ~524 nm with low Stokes-shift. Through XRD characterization it was noted the perfect formation of the polycrystalline film of HPs, the superior crystallinity and order of this compound and the effect of different organic cations.

Fluorescence lifetime measurements were performed on the selected sample using an EPL-405 picosecond pulsed laser operating at 405 nm. It has been shown that these two classes of materials had a fast luminescence decay (~1ns), making them suitable for potential applications as fast scintillators. The two 2D-HPs in the formulation with the best performance were subjected to Ion Beam-Induced Luminescence (IBIL) experiments using protons (H+) and, in particular, the scintillation performance of the PEA2PbI4 family under alpha particle excitation by an 241Am source was reported in comparison with a standard commercial scintillator.

Primary author: CALORA, mario

Co-authors: Dr MASTRIA, Rosanna; Dr GIURI, Antonella; Dr PINO, Felix; Prof. MORETTO, Sandra; Prof. QUARTA, Gianluca; CALCAGNILE, Lucio; QUARANTA, alberto; Dr RIZZO, aurora; Prof. CARICATO, anna-paola

Presenter: CALORA, mario

Session Classification: Session 4 (Posters)

Track Classification: default track