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Multi-layer structure for thermal neutron detection: CsPbBr3 thin films coupled with 10B conversion layers

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Scintillators are versatile indirect-type detectors finding applications in many strategic fields such as nuclear medicine, imaging, high energy physics, and homeland security. Given the outstanding photophysical properties of Metal Halide Perovskite (MHPs) along with the successful application in disparate optoelectronic devices, their use as scintillator detectors is emerging with very promising advantages: low costs, fast response high quantum yield, strong absorption, scalability, flexibility and tunability of the emission wavelength. Given the effectiveness of perovskites as α particle detectors, and the potential of 10B as a neutron converter, in this paper a 10B converting layer was coupled with an all-inorganic lead halide perovskite (CsPbBr3) layer aiming to create an high-performance thermal neutron detector for medium-high fluxes. The response of a bi-layer structure, CsPbBr3 (1 μm thick)/10B (1 μm thick), deposited by laser ablation (LA) on carbon fiber, has been investigated when exposed to a 252Cf neutron source. Monte Carlo simulations have been carried out to support the experimental evidence.

Authors: Dr MONTEDURO, Anna Grazia (Dipartimento di Matematica e Fisica ”E. De Giorgi”, Università del Salento and INFN-Le); CARICATO, Anna Paola; Dr PROVENZANO, Chiara (Dipartimento di Ingegneria dell’Innovazione and INFN-Le); PINO, Felix; Prof. QUARTA, Gianluca (Dipartimento di Matematica e Fisica ”E. De Giorgi” and CEDAD (Università del Salento) and INFN-Le); Dr DELAGO, Jessica C. (Dipartimento di Fisica e Astronomia, Università di Padova); Dr MARRA, Marcella (Dipartimento di Matematica e Fisica ”E. De Giorgi”, Università del Salento and INFN-Le); Prof. MARTINO, Maurizio (Dipartimento di Matematica e Fisica ”E. De Giorgi”, Università del Salento - INFN-Le); Prof. MORETTO, Sandra (Dipartimento di Fisica e Astronomia, Università di Padova and INFN-Pd)

Presenter: CARICATO, Anna Paola

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