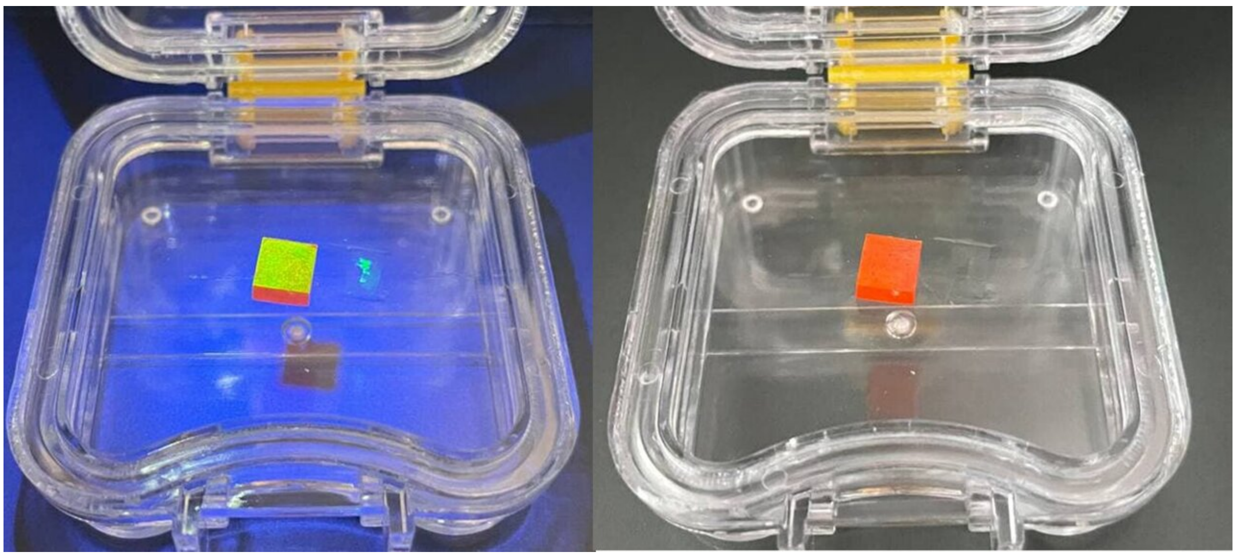
Scientists develop a material for use in radiation-tolerant devices

May 18 2022



CH3NH3PbBr3 (MAPbBr3) monocrystal imaging under UV light and under visible ambient ligh. Credit: Arthur Ishteev

Russian scientists have developed a unique material based on halide perovskites for use in high-speed and highly sensitive ionizing radiation detectors. The study has been published in the *Journal of Materials Chemistry C*.

Halide perovskites are a new class of semiconductor materials with a unique combination of optical and electronic properties, such as high photoluminescence and charge mobility, which makes them a promising basis for the highly sensitive detectors and ionizing radiation scintillators creation. Perovskites are known as excellent light absorbing and emitting material for light-emitting devices, sensors, solar panels, and other devices in which light affects the current.

Perovskites have attracted considerable attention from both academia and industry, including the world's largest laboratory of high-energy physics—CERN.

Perovskite responds to ionizing radiation in the form of light (luminescence) or current (as a photodiode). This is useful for high-speed and high-sensitivity components for high-energy particle registration. However, the structures inside the collider are exposed to high doses of radiation, which can damage them. Accordingly, components of ionizing radiation detectors must be resistant to such effects and retain their properties for a long time.

Scientists from NUST MISIS together with their colleagues from Italy report that the $CH_3NH_3PbBr_3$ ($MAPbBr_3$) perovskite monocrystal retains its optical properties and structural stability under harsh radiation doses.

"The shelf-life cycle of the high energy experiments is about five to seven years. Our goal was to make a material that performs all the tasks and withstands high doses of radiation and does not lose properties over the cycle of the experiment," says Arthur Ishteev, the main author of the work and a research fellow at NUST MISIS Laboratory for Advanced Solar Energy.

In addition to X-ray and photodetectors, perovskite monocrystals can be used in nuclear reactors, calorimeters, radiology and other devices using radiation.

More information: Arthur Ishteev et al, Investigation of structural and

optical properties of MAPbBr3 monocrystals under fast electron irradiation, *Journal of Materials Chemistry C* (2022). DOI: 10.1039/D2TC00128D

Provided by The National University of Science and Technology MISIS