PASION - DEVELOPMENT OF NEW SURFACE PASSIVATING IONOGEL TECHNOLOGY FOR MESA-TYPE DETECTOR STRUCTURES

The aim of the PASION project is to revolutionize the technology of photon infrared (IR) detectors by taking up the key challenge of developing an effective and an inexpensive passivation method ensuring the elimination of unwanted surface leakage currents in small devices with a "mesa" structure.
In photon detectors, incident radiation is absorbed in the semiconductor material due to the interaction of photons with electrons, and the detector signal is recorded as a photocurrent, i.e. an increase in current above the dark current value. Photon IR detectors, commonly used in various fields such as astronomy, non-contact diagnostics, security, thermal imaging, however, often have limitations in operation due to increased dark currents resulting from unwanted currents flowing along the etched surface of the mesa structure. This is particularly important in devices with small pixels, when the ratio of the perimeter to the detector surface is large - the ratio of surface current to volume current is also large.
To solve this, the PASION project is developing a novel passivation materials based on polymerizable ionic liquids and ionogels. These hybrid materials combines the flexibility of ionic liquids (specialized liquid chemicals) with the stability of solid frameworks. Proposed materials can effectively fill and stabilize the tiny gaps and imperfections on the detector's surface, thereby reducing unwanted electrical currents and improving overall performance.

Key features of this new passivation method include:

1. **Chemical Passivation**: it fills and stabilizes surface defects at a molecular level.
2. **Protection Against Reactions**: it shields the surface from harmful environmental factors.
3. **Temperature Stability**: it maintains effectiveness across a wide temperature range.
4. **Ease of Use**: it can be applied using standard manufacturing techniques.
5. **Single-Step Processing**: it simplifies production, making it more efficient and cost-effective.

The project is a collaboration between Poznan Science and Technology Park, Łukasiewicz Institute of Microelectronics and Photonics, and the Military University of Technology. Together, they aim to create a universal material platform that enhances the performance of IR detectors, paving the way for more advanced and reliable technology in numerous fields.