

## Ionic liquids as mesa surface passivators in IR detectors

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This work presents a novel approach to the passivation of infrared detector structures using ionic liquids (ILs). The proposed method was applied to both HgCdTe photodiodes operating in the mid-infrared range and InAs/InAsSb type-II superlattice mesa detectors. The experiments yielded promising results in both device types. In both cases, the ionic liquid served as an effective surface passivator, significantly reducing dark current density and improving device stability.

ILs, thanks to their low vapor pressure, chemical resistance, and ability to form a uniform nanometric layer, can be easily applied directly onto the detector surface. The measured dark current density–voltage characteristics show that detectors with IL passivation applied to the mesa sidewalls exhibit reduced dark currents. We believe that the primary passivation mechanism is the formation of an electric double layer (EDL) in the IL, which screens charges at the semiconductor surface<sup>1</sup>. These findings demonstrate the potential of ionic liquids as multifunctional materials for next-generation infrared detectors, enabling cost-effective, fast, and robust passivation solutions.

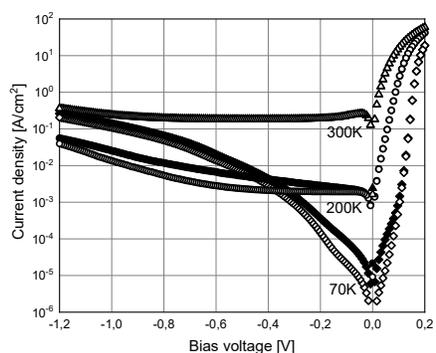


Fig. 1. Dark current density versus bias voltage of the HgCdTe detector measured at different temperatures before and after IL passivation. The black full symbols correspond to a non-passivated device, and the empty symbols correspond to a passivated one.

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## References

1. Nyga, M.; Boguski, J.; Szawcow, O.; Kopytko, M. *J. Appl. Phys.* **2025**, *137*, 175702.



Dr. Małgorzata Nyga completed her Master's degree at the Faculty of Chemistry, University of Warsaw, Poland. She began her professional career at the Institute of Nuclear Chemistry where she defended her PhD dissertation in 2016. Her research focused on radiation-induced chemical reactions in selected ionic liquids. She is currently working at the Military University of Technology on ionogels and ionic liquids for passivation of mid-infrared HgCdTe and InAs/InAsSb type-II superlattice mesa detectors.