White Paper on HE Call Topic:	Deadline Date
HORIZON-CL4-2026-05-MAT-PROD-25: New or enhanced Innovative Advanced Materials (IAM) enabled sensing functionality (RIA)	15 Apr 2026

Potential Project Concept

Development of a sustainable, advanced material–based sensing platform for selective detection of volatile organic compounds and hazardous gases, enabling low-power, high-performance sensor systems for environmental monitoring and industrial safety applications.

The sensing platform will be based on stimuli responsive polymer-engineered multifunctional surfaces that will integrate nanostructured polymer sensing layers with ultrathin, selectively permeable polymer membranes to control diffusion, enhance selectivity, and suppress cross-sensitivity to humidity and temperature fluctuations. The design will combine selective analyte recognition, signal amplification, and environmental robustness.

Novelty:

- **Sustainable and scalable fabrication** by using solvent-free, low-temperature polymer deposition and nanostructuring methods, that minimize energy and material consumption and are compatible with silicon-based manufacturing.

- **High-sensitivity sensing** by using nanostructured and fibrous polymer materials with high surface-to-volume ratios to achieve fast response times and low limits of detection.

- **Encapsulation** to enable reliable operation under harsh and variable environmental conditions.

- **Sensor arrays with differentiated selectivity** to enable multi-gas detection and improved selectivity of hazardous compounds through utilization of multi-functional materials.

The developed surfaces will be integrated into miniaturized MEMS-based sensor platforms with low-power readout electronics and wireless communication capabilities, suitable for deployment in distributed IoT networks.

Potential Contributions to the Call Topic

Together, the two partners (Sabanci University and University of Malta) provide a complementary skill set that supports multiple project directions including both IAM-enabled multifunctional surfaces and integrated IAM-based sensor demonstrators. The collaboration enables co-development of intelligent polymer-based sensing materials and MEMS platforms, with optimized material functionality, device architecture, and system integration.

Potential project contributions include the development of selective and environmentally robust IAM coatings for gas and chemical sensing, multifunctional sensing surfaces capable of responding to multiple environmental stimuli, and hybrid thin-film/nanostructured materials developed via sustainable processing methods. These IAMs can be integrated into miniaturized MEMS-based sensors compatible with silicon technology, designed for low-power operation and stable performance under real-world conditions.

Expertise of Sabancı University (SU)

Dr. Gozde Ince brings expertise in the design and scalable processing of polymer-based advanced materials for sensing applications, focusing on vapor-deposited polymer thin films and polymer nanostructures. This expertise enables the development of multifunctional sensing surfaces with precisely engineered chemical selectivity, transport properties, and environmental stability.

Vapor-phase polymer deposition techniques used by Dr. Ince allow solvent-free, low-temperature, and conformal coating of functional polymers on silicon, flexible substrates, and complex three-dimensional microstructures. These methods support fine control over film thickness, composition, and interfacial properties, enabling different material layers that combine sensing, signal modulation, and environmental protection within a single material system.

In addition, Dr. Ince has strong expertise in the fabrication of nanostructured and fibrous polymer materials, including both synthetic polymers and bio-derived polymers (e.g. lignin and cellulose), with particular emphasis on one-dimensional nanostructures exhibiting high surface-to-volume ratios. These materials provide intrinsic signal amplification, fast response times, and low detection limits, while maintaining mechanical flexibility and lightweight characteristics. These nanostructured sensing layers can be combined with thin-film membranes or encapsulation layers to achieve a balance between sensitivity, selectivity, durability, and resistance to humidity and temperature variations.

Prof. Gozde Ozaydin Ince is the head of the Functional Thin Films Laboratory at SU. She has extensive expertise on design and development of surface coatings, functional polymer thin films and nanofibers for biomedical and electronics applications. Her research focus is mainly on the functionalization of nanostructures by stimuli responsive organic coatings via vapor deposition methods (Scopus ID: 26639579100, Orcid: 0000-0003-3255-4940).

Sabancı University (SU) has been actively involved in EU-funded research projects since FP6. As of March 2025, the university manages nearly €63.4 million in active research funding across 244 projects, 52% of which are EU-funded. This includes 27 active HE projects, with 15 coordinated by SU. With a €7.06 Million Net EU contribution under Horizon Europe, SU ranks one of the highest among all universities in Türkiye, according to the EU Horizon Dashboard.

Expertise of University of Malta (UM)

The Department of Micro and Nanoelectronics at the University of Malta (UM) is actively engaged in research and development in analogue and digital IC design, MEMS sensor design, and the integration of smart microsystems for IoT applications. The Department has designed and fabricated numerous IC prototypes through Europractice multi-project wafer (MPW) runs. It also houses a state-of-the-art MEMS Characterisation Laboratory equipped with an optical MEMS test bench for dynamic and static characterisation.

UM has significant experience in national and international collaborative projects. It was a partner in the FP6 project SENSATION, focusing on a body area network for medical applications and a high-speed driver-assist camera. This was followed by participation in ENIAC/ECSEL projects LAB4MEMS and LAB4MEMS II, where UM contributed MEMS/MOEMS modelling, prototype testing, and development in the areas of wafer-level moulding, tuneable capacitors, and magnetic compass sensors. Additionally, in the PENTA

project ESAIRQ, UM developed a low-power wireless multi-sensor network for indoor air quality monitoring and contributed to MEMS and ASIC interface design for a near-infrared gas spectrometer.

The Department also participated in the Xjenza Malta - TUBITAK PolyMEMSens project, where it was responsible for the design of piezoelectric MEMS resonator gas sensors. In PolyMEMSens. UM developed the MEMS structures, supported integration with functional polymers, and contributed to the performance evaluation of the sensors.

The team at UM includes: **Prof. Ivan Grech** (Principal Investigator): expert in low-power CMOS circuit design and MEMS, with a Ph.D. from the University of Surrey and over 120 peer-reviewed publications together with **Prof. Ing. Joseph Micallef** and **Dr. Ing. Russell Farrugia**.

Link to publications:

https://www.um.edu.mt/ict/mne/ourstaff/ivan/