VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Natalia Andrea Gutierrez Andrade**

The public defense will take place on **Thursday 18th June 2026 at 4pm** in room **D.0.08** (Building D, VUB Main Campus)

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TOWARDS THE DETECTION OF MICROPLASTICS IN LIQUIDS USING SURFACE PLASMON RESONANCE

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Abstract of the PhD research

Microplastics are an emerging environmental pollutant already detected in remote ecosystems such as the Pacific trenches, the North Pole, and even the atmosphere. Their widespread presence has been associated with multiple harmful effects on organisms and ecosystems, ranging from obstruction of the digestive or respiratory tracts to endocrine disruption and the transport of toxic substances and microorganisms. These alarming findings have prompted global health authorities to establish regulations aimed at mitigating the effects of microplastics on the environment and human health. However, progress has been limited by the absence of standardised methods for their detection and analysis.

Microplastics encompass a wide variety of polymer types, particle sizes, shapes, and quantities, all of which influence their toxicity and environmental behaviour. Consequently, analytical methods must address all these parameters to enable comprehensive assessment and traceability. Existing analytical techniques, including vibrational spectroscopy (Raman and FTIR) and mass spectrometry, are capable of addressing these parameters, yet they remain constrained by time-consuming measurements, complex instrumentation, and limited reproducibility. To overcome these challenges, alternative approaches are being explored, among which surface plasmon resonance (SPR) shows promise due to its real-time detection capability, high sensitivity, and potential portability.

This PhD research focuses on developing a proof-of-concept SPR-based sensor for microplastics detection. Polymer sensing was first achieved using a tailored prism designed through analysis of the Kretschmann configuration. SPR imaging was then incorporated to enable simultaneous assessment of multiple particle parameters. Finally, a microfluidic system was integrated to exploit SPR's real-time capabilities for rapid analysis in liquid samples. The developed sensor enhances SPR applicability to microplastics detection and demonstrates strong potential to address current analytical challenges in this field.