

Integrating Surface Plasmon Resonance (SPR) Approach for Next-Generation Materials/Aerospace Systems: From Nanostructured Coatings to Embedded SPR Sensors



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Dr. Sunday Atuba

Senior Lecturer in Electronics Engineering

Fibre Optics, Photonics, Electronics, Embedded Systems.

Sunday.atuba@uwe.ac.uk



Research Overview

A key challenge in the aerospace sector is the need for highly sensitive, real-time methods to characterise surfaces, monitor structural health, and optimise advanced coatings, particularly under extreme operating conditions. Addressing this is vital for improving safety, performance, and longevity of next-generation aircraft and spacecraft. While SPR has been widely studied for biosensing and unique selling points have been demonstrated for telecommunication applications, its immense potential in aerospace remains largely unexplored and offers a promising direction for future innovation.

Industry Relevance

- Real-time surface and coating characterization for aircraft and spacecraft components
- Early-stage corrosion and oxidation detection.
- Predictive Maintenance and Advanced Communication technologies.
- Reduced maintenance costs, enhanced safety, improved fuel and operational efficiency through optimized material performance.

Methods & Technologies

- SPR for Real-time monitoring
- Modelling and simulation (COMSOL): To predict plasmonic behaviour and material performance
- Optical and plasmonic characterisation: To assess thin films, coatings and surface chemistry
- Cross-disciplinary capability linking engineering, materials science, and photonics (Materials engineering facilities for surface engineering and expertise in SPR sensor development).

Designs / Innovations



(A) Geometry for surface plasmon wave. **(B)** The basic Kretschmann configuration. **(C)** Diffraction grating configuration. **(D)** Waveguide configuration

Opportunities

- Joint development of next-generation sensing systems
- Integration of SPR into Structural Health Monitoring (SHM) frameworks with existing NDT.
- Technology translation and prototyping. Data-driven performance modelling
- Joint funding and innovation bids. Custom sensor design for specific assets

