EPSRC
Engineering and Physical Sciences Research Council

EPSRC Centre for Doctoral Training in Sustainable Materials and Manufacturing

Title: **Computational Modelling and Optimisation of Plasma Processes**

Supporting Company: **Oxford Instruments plc**

Location: Streatham Campus, University of Exeter, EX4 4QJ

Primary Supervisor: Prof. Gavin Tabor

Secondary Supervisors: TBC

Project Description

The collaboration with the named project partner is subject to contract. Please note full details of the project partner's contribution and involvement with the project is still to be confirmed and may change during the course of contract negotiations. Full details will be confirmed at offer stage.

One of Oxford Instruments' key technologies is surface modification by plasma processing, which utilises plasmas of different chemical compositions to deposit onto and etch surfaces in a controlled manner – this is the method by which the majority of the world's semiconductor devices are manufactured. This technology is at the heart of the PlasmaPro device range. Development of this technology and product relies on a detailed understanding of the physics of the plasma and chemical kinetic reactions, with reproducibility and control of the process being key customer issues. Sustainability issues are also important, with a push to reduce the use of greenhouse and ozone-damaging gasses in the process such as SF6.

The project will apply physics-based and data-based modelling techniques to model a range of the processes in the PlasmaPro 100 device across a range of scales, from localised processes in the plasma sheath and feature-scale simulation to whole-system modelling. Physics-based modelling will include continuum mechanics modelling of flow and reaction using OpenFOAM, and potentially kinetic theory calculations using OpenFOAM and other open source codes. The data-based modelling will apply techniques from AI and Machine Learning such as Supervised and Reinforcement learning, working in conjunction with the physics-based modelling and with experimental data. One target for the project will be to create AI-based control software to manage complex aspects of the plasma environment andenable machine learning based process development.