

STUDENT EXPERIENCE INTERNSHIP (SEI) PROGRAMME

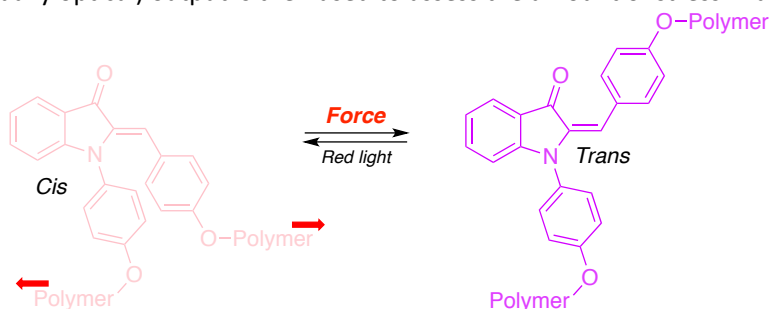
LEARNING THROUGH RESEARCH INTERNSHIP TEMPLATE 2025

Title of the Learning Through Research internship:

Synthesis and investigation of a molecular force-probe

A summary of the internship or project outlining the key aims and objectives (in no more than 500 words):

Mechanical force is a formidable source of energy that, with its ability to distort, bend and stretch chemical bonds, is unique in the way it activates chemical reactions.^[1] It is also responsible for materials degradation and fatigue that ultimately lead to failure. In order to anticipate (and prevent) a catastrophic failure of a material, chemists have started to investigate force-probes that react upon application of a mechanical stimulus (stretching for example) to deliver a readable output. This (usually optical) output is then used to assess the amount of stress in a particular material.



In this project we propose to investigate the mechanical activation of an hemiindigo optical probe for damage detection.^[2] Hemiindigo adducts can exist in two different configurations (cis or trans) that have different optical properties (the absorbance is such that the two isomeric states to be distinguished by the naked eye). The project will start by the synthesis of the hemiindigo chromophore appended with two initiators of radical polymerization. This compound can be easily obtained in 3 steps, the synthesis of which has been established in our lab by an undergraduate student. Polymers (typically polystyrene) will be grown either side of the mechanophore by controlled radical polymerization. The mechano-optical properties of the obtained probe will be investigated.

References. [1] M. M. Caruso, D. A. Davis, Q. Shen, S. A. Odom, N. R. Sottos, S. R. White, J. S. Moore, *Chem. Rev.* **2009**, *109*, 5755–5798.
[2] Petermayer, C.; Thumser, S.; Kink, F.; Mayer, P.; Dube, H. J. *Am. Chem. Soc.* **2017**, *139* (42), 15060–15067.

A list of what the student's key activities and duties will be (in no more than 500 words):

The student will have the opportunity to train on various aspects:

- *Organic synthesis:* synthesis of the mechanophore
- *Small molecules characterisation:* NMR and Mass Spectrometry
- *Polymer synthesis:* Controlled radical polymerisation techniques (SET-LRP)
- *Polymer characterisation:* NMR, GPC

The skills required to apply to the internship:

Please list the skills and attributes you require applicants to possess. These are the criteria used to shortlist candidates so should be both general (e.g. teamworking, communication) and specific (e.g. technical competencies).

Essential skills & attributes

- Experience in organic synthesis
- Experience in small molecule characterisation (NMR and MS spectra interpretation)

Desirable skills & attributes

- Polymer synthesis

Please specify the planned working arrangements for the project (e.g. in-person or hybrid):

- **In person, lab-based**