

# SEMS: RESEARCH PROJECT DESCRIPTION

## 1. Project Background and Description

### **Autonomous Shape-Programmed Nanomaterials by the ancient art of Kirigami. At the interface between Materials Science, Art and Robotics.**

In last few decades, nanotechnology unveiled unprecedented intrinsic materials properties. But this technological revolution is still in its infancy. Having simple and scalable methods to accurately control nanoparticles in (3D) space and in time, over different length scales, up the macroscopic level, has proven to be a difficult task and a fundamental challenge to unleash the promise of nanomaterials and nanotechnology.

This project will develop fundamental insights into a strategy to control the position of nanoparticles in 3D and time, taking inspiration from the ancient Japanese art of cutting and folding (kirigami). In doing so, the project paves the way to scientific breakthrough in understanding and manipulating nanoparticles, nanocomposites and their properties, in a way that will impact many scientific fields like materials science, engineering, physics, biology and technological fields, from soft-robotics, wearable electronics, energy to space.

## 2. Project Scope

This project will pursue the following key objectives:

1. Develop the fundamental scientific understanding of how nano-particles can be predictably and accurately positioned in 3D space.
2. Develop the fundamental scientific understanding of how nanocomposites films can be predictably self-actuated into 3D shapes and in time.

## 3. Desired Skills from the Student

The ideal PhD candidate will have a University degree in Material Science and Engineering or equivalent subjects and knowledge of aspects of: i) Polymer processing, ii) Microfabrication, iii) Mechanical and Electrical Characterisation, iii) and iv) Nanomaterials and Nanoparticles.

## 4. Supervisors

Primary Supervisor: Dr. Emiliano Bilotti. [e.bilotti@qmul.ac.uk](mailto:e.bilotti@qmul.ac.uk)

Secondary Supervisor: Dr. Han Zhang. [han.zhang@qmul.ac.uk](mailto:han.zhang@qmul.ac.uk)

Secondary Supervisor: Dr. Dimitrios Papageorgiou. [d.papageorgiou@qmul.ac.uk](mailto:d.papageorgiou@qmul.ac.uk)