

SynBio-Inspired Nanomaterials Manufacturing

Inspired by **Nature** • Enabled by **Research** • Harnessed for **Market**

4 years, £1.9 million, 3 themes, 3 universities, 15 people, wide impact!

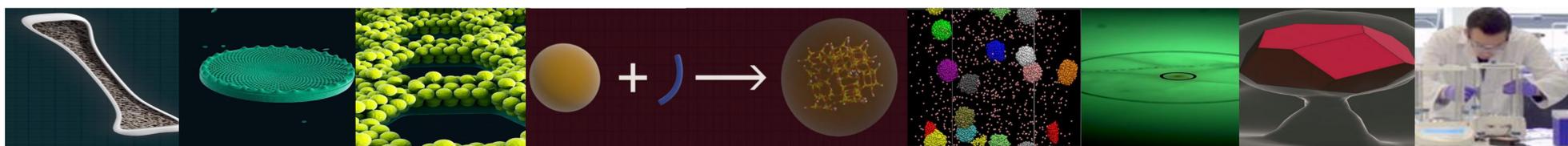
Aim

The SynBIM project aims to create transformative knowledge and toolsets needed to enable larger-scale manufacturing of tuneable nanomaterials, using an eco-friendly “green” Synthetic Biology (SynBio) approach.

Concept

Current nanomaterials manufacturing is significantly wasteful, while Nature produces a wide range of sophisticated nanomaterials (biomineralisation) under ambient conditions. By harnessing biomineralisation principles, we can synthesise nanomaterials with almost no waste. Our understanding on particle formation pathways and factors affecting scale up production, can lead to highly tuneable and industrially relevant products.

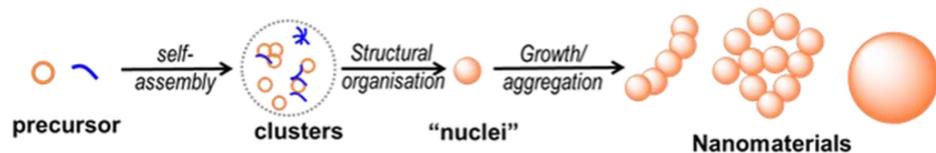
From Nature, through Research, to Industry



1 project, 3 research themes: Understanding, designing, manufacturing

1. Understanding particle formation pathways

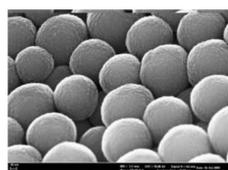
Fundamental research, in order to understand formation pathways, self-assembly processes and their associated influences on nanomaterial properties. In order to understand more about particle formation pathways, 2 areas are examined: clustering & self assembly, and effects of flow & mixing.



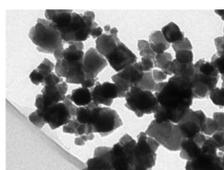
Pathway towards nanomaterial formation

2. Product design

Aiming at designing scalable synthesis by specifying SynBio-additive chemistry and synthetic conditions to produce products with tuneable properties. Conditions such as concentrations of precursors and additives, additive origin and chemistry, reaction time and pH are investigated, for the production of silica and magnetite nanoparticles.

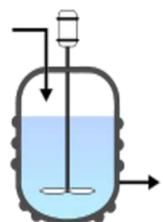


Silica nanoparticles (left)
Magnetite nanoparticles (right)



Process conditions

Additive Chemistry

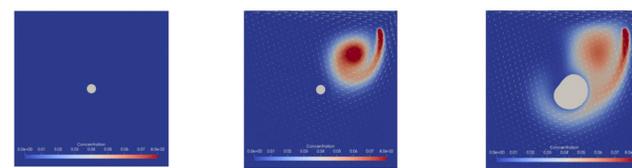


Nanomaterial properties

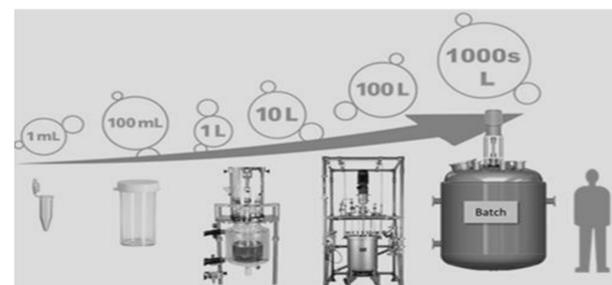
Controlling the conditions and chemistry of the reagents used, we are able to control the properties of the final product (“dial-a-property”)

3. Scale up and manufacturing

The unknown relationships between nano-particle formation pathways, fluid dynamics, synthesis scale and nanomaterial properties are explored, based on knowledge developed in previous themes. Mixing and batch reproducibility are important factors during scale up of bioinspired silica and magnetite nanoparticle production.



2D simulation of advected material deposition, causing particle growth in a lid-driven cavity flow.



Scalability pathway

Our sponsors and collaborators

