Ready, Steady, Engineer!

3D Printing for Outreach and Research

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Upcoming website:
www.readysteadyengineer.wordpress.com

AIMS

1. **To develop 3D printing projects and resources that will be used to inspire school pupils to think about a career in engineering, and demonstrate the potential of 3D printing for creating personalised objects. Biomedical engineering is a key example of an area where such techniques are widely used.**
2. **To develop 3D printable polymers which contain added functionality, such as photocatalytic sites, which can be used in the design of 'greener' chemical transformations using water as the solvent and which require no subsequent catalyst separation steps.**

Outreach

Many schools now have basic 3D printers and are looking for innovative and engaging ways to utilise these resources. The aim of this project is to introduce school pupils to Science, Technology and Engineering as the spring board for future potential careers. We will aid this by exploiting the huge potential of 3D printing technology to allow early secondary school students to personalise their approaches to solving science-based projects and problems.

Goals

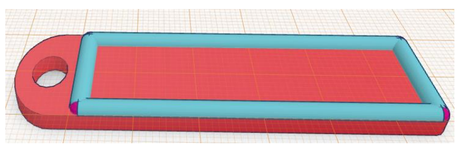
- **Increase students' perceptions of the breadth of careers in science, technology and engineering**
- **Help them to gain confidence in their own potential in these careers by guiding them through 3D printing projects**
- **Develop resources that will allow teachers to run and develop their own 3D printing projects**

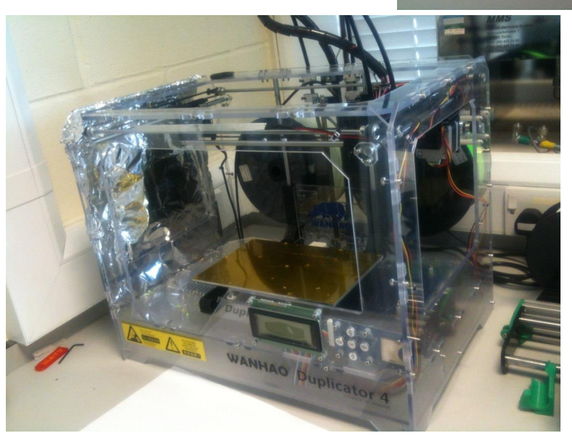
Plan

- Design short projects for school pupils which will use pre-existing 3D printing equipment.

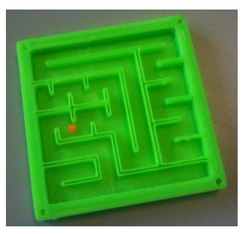
An introduction to **Bio-medical Engineering** using 3D printing

Introduction to **Computer Aided Design (CAD)** using Tinkercad (www.tinkercad.com)

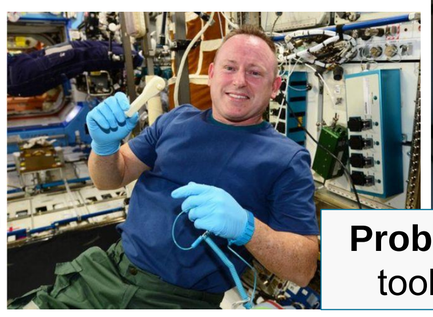


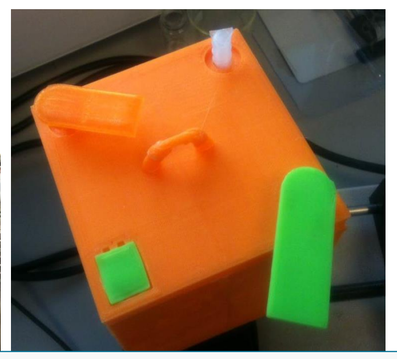


Personalisation of products



3D printing has already been used in space to produce customised tools when required. Credit: NASA





Problem solving: Build your own tools which can open 'the box'

Research

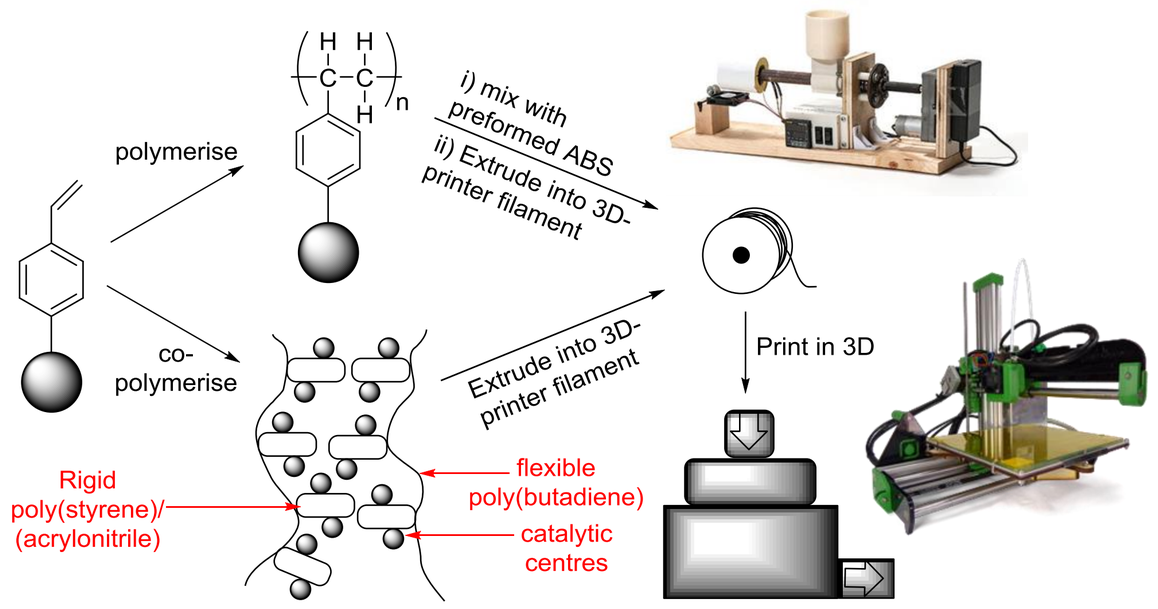
3D printing promises a revolution in the way objects are created with the potential to transfer manufacture from large factories to individual homes. **Form** is easy to reproduce but what currently is missing is **function**.
The aim of this project is to develop new polymers that are capable of being 3D printed that include additional functionality such as photocatalytic sites or ligand sites for binding metals which can act as catalysts.

Goals

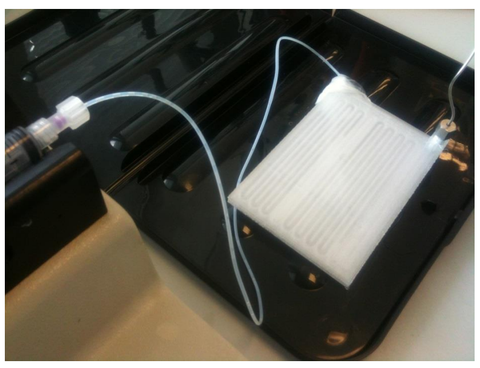
- **Synthesise new 3D-printable polymers that contain extra functionality including photocatalytic sites**
- **Develop 3D printed reactors that utilise the catalytic properties of these new materials.**

Plan

- ABS (acrylonitrile-butadiene-styrene co-polymer) is one of the two most commonly used plastics for 3D printing due to its useful properties (it is also the plastic used in Lego), so modifying this polymer will be the initial target of this project.



- Develop flow reactors made from ABS polymer which contains catalytic sites. Heterogeneous catalytic reactions will then be developed so that chemical transformations can be accomplished which will generate the desired products directly without additional separation steps.



Prototype flow reactor

Next steps: Research

Combine the new functionalised polymers with customisable flow reactor designs for testing in heterogeneous catalytic processes, particularly in 'green' processes using water as the solvent

Next steps: Outreach

Take projects into a local secondary school. Update and finalise internet resources so that the projects are stand-alone and can be run at any school with a 3D printer

Want to know more?

- H. Dodziuk, What's New in 3D Printing? DOI: 10.1002/chemv.201300064
- M. D. Symes, L. Cronin *et al.*, *Nat. Chem.*, 2012, **4**, 349.

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