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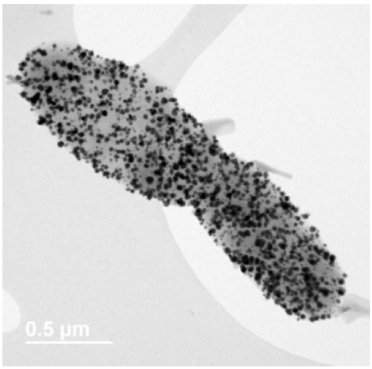
Exploiting the commercial potential of novel biometallic catalysts

"The BIV provided a quick, convenient and effective route for us to bring together the Manchester group's expertise in bioproduction of metal particles with Johnson Matthey's catalysis know-how. We have begun to determine the potential of this technology for the production of novel catalysts." Nigel Powell, Johnson Matthey.

Jon Lloyd, Nick Turner and Richard Kimber, University of Manchester; Nigel Powell, Johnson Matthey

OUTCOMES: Metal-reducing bacteria can accumulate metals from process environments in the form of catalytically active nanoparticles, offering a simple and green method for high-value nanoparticle production. These nanoparticles have many applications, including in the production of fine and speciality chemicals such as pharmaceutical intermediates, fats and oils, and upgrading of fuels and biorenewables. Bimetallic nanoparticles offer a number of advantages over their monometallic counterparts due to the combined properties of the two metals present, and through new properties created from the synergy between these metals.

We investigated the potential for a metal-reducing bacterium to produce bimetallic nanoparticles from metal solutions containing a range of metals supplied in combination. Metallic nanoparticles were biosynthesised at the University of Manchester and then Johnson Matthey's scanning transmission electron microscopy facilities were used to characterise the products. We found that the pattern of distribution of the metallic nanoparticles was highly dependent on the combination of metals supplied to the cells. Evidence was provided for the formation of bimetallic nanoparticles for some examples of metal combinations, and these nanomaterials are the focus of future work.



Bimetallic nanoparticles produced during the project

INITIAL AIMS: This project brings together biotechnologists from the University of Manchester and experts in industrial catalysis at Johnson Matthey, a leading multinational specialty chemicals and sustainable technologies company headquartered in the UK. This project will facilitate collaborative discussions required to underpin the development and exploitation of a new generation of 'biometallic' industrial catalysts. These are based on naturally occurring metal-reducing bacteria that are able to accumulate metals from process environments (as catalytically active nanoparticles), while also expressing enzymes that are able to extend the range and complexity of industrial reactions that can be produced from these novel microorganisms. This novel extension of synthetic biology has the potential to transform several sectors of UK industry, including those of industrial biotechnology and makers and users of catalysts, simplifying current processes, underpinning novel reactions and extending the range of available products.

- Obtained further funding through a BBSRC NIBB Proof of Concept award
- Industrial partner supported successful BBSRC Responsive Mode grant awarded to academic partner