Alloying Gold with Copper Makes for a Highly Selective Visible-Light Photocatalyst for the Reduction of Nitroaromatics to Anilines

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Presentation Preference: Poster

Career Level: Post Graduate Student or Early Career Scientist (<5 yrs post PhD)

Aligned with Science Focus: photo-catalysis

Abstract:

Finely control of product selectivity is an essential issue in catalysis. In the synthesis of functionalized anilines via reduction of the corresponding nitroarenes, the challenge is to selectively reduce only the nitro group in the presence of other reducible functional groups in nitroarene molecules at a high reaction rate. Normally, the nitroarene is reduced stepwise through a series of intermediates that remain as by-products, increasing the aniline synthesis cost. Here we report that alloying small amounts of copper into gold nanoparticles can alter the reaction pathway of the catalytic reduction under visible-light irradiation at ambient temperature, allowing nitroaromatics to be transformed directly to anilines in a highly selective manner. The reasons for the high efficiency of the photocatalytic reduction under these comparatively benign conditions as well as the light-excited reaction mechanisms are discussed. This photocatalytic process avoids by-products, exhibits a high reaction rate and excellent substituent tolerance, and can be used for the synthesis of many useful functionalized anilines under environmentally benign conditions. Switching of the reaction pathway simply by tailoring the bimetallic alloy NPs of the photocatalysts is effective for engineering of product chemoselectivity.

Biographical Statement of speaker:

Dr. Kevin Xiao is now an OCE Postdoctoral Fellow at CSIRO Manufacturing, working on plasmonic nanoparticles for photocatalysis. He received his PhD in Materials Chemistry from QUT in July 2015. His research interests mainly focused on exploring novel metal nanoparticle photocatalysts and using visible light to drive the synthesis of fine organic chemicals. Dr. Xiao has accumulated rich experience in plasmonic metal nanoparticle photocatalysis and nanomaterials.

Google Scholar: http://scholar.google.com.au/citations?user=Ffj5zR8AAAAJ&hl=en