

## **Investigating the Opposing Catalyst Compositions required for Gas and Liquid Phase Selective Alkyne Hydrogenation**

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### **Abstract**

Selective alkyne hydrogenation is an industrially important reaction typically used to remove alkynes in monomeric alkene streams. Alkynes are known to poison the catalysts used to polymerise the alkenes. Therefore, the gas stream is passed over, primarily, palladium-based catalysts beforehand to lower the alkyne concentration to below 10 ppm. Ideally this can be achieved without converting the alkene to the alkane and without producing oligomers known as green oil in the case of acetylene removal in ethylene feeds.

Selective hydrogenation reactions of acetylene and phenylacetylene have been undertaken using catalysts comprising of palladium-silver nanoparticles supported on various metal oxides. Using both a combination of palladium and silver affords a balance of the high selectivity of silver and the high activity of palladium resulting in a more efficient catalyst. This synergy is seen with other bimetallic catalysts across a range of applications. The catalysts in this work were prepared by sol immobilisation, where the dissolved metal salts were reduced in situ with sodium borohydride whilst being stabilised by a polymeric agent. It is known that this method produces small, uniform nanoparticles, which has been shown in the field to give better selectivity and hence a better catalyst. We found that selective hydrogenation of gas-phase acetylene and liquid-phase phenylacetylene required opposite catalyst compositions. That is low Pd content for acetylene hydrogenation and high Pd content for phenylacetylene hydrogenation. We will be presenting EM images, XPS and TPR as well as the catalytic reaction data to rationalise our observations.

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