The heterogeneous oxidation of hydrocarbons is of fundamental interest in the production of fine chemicals. When oxygen is used as the oxidant, harsh reaction conditions tend to be employed – typically high temperature and pressure. Today the concept of green chemistry and sustainability is a key consideration and processes are required that can effectively utilise raw materials, reduce waste and avoid the use of toxic intermediates under mild reaction conditions. The initial discovery by Haruta[1] that finely dispersed supported Au nanoparticles are exceptionally active for CO oxidation at sub ambient temperatures was followed by the successful utilisation of Au catalysts for a wide range of highly selective, clean oxidation reactions which operate under very mild conditions. Typically, these catalysts contain high concentrations of Au (2.5-5wt%).

It has been shown that preparation of catalysts with low Au content can be prepared, whilst retaining high activity. This was elegantly demonstrated for CO oxidation where it was shown just 1% of the Au comprises the active site in an 5wt%Au/Fe₂O₃ catalyst[2]. Extremely active low loaded Au catalysts are also obtained by careful CN leaching of a preformed catalyst; a 0.001wt%Au/CeO₂ catalyst reported by Fu contained just Au³⁺ on the surface and showed high efficacy for the water gas shift reaction[3].

Cyanide leaching was used to obtain Au/SiO₂ catalysts with very low gold loadings. A number of catalysts with a nominal 5 wt% target loading were prepared using impregnation and deposition precipitation techniques and these were found to be active catalysts for the solvent-free aerobic oxidation of benzyl alcohol. Exposure of these catalysts to a basic solution of NaCN for 10 minutes leached gold from the materials to give very pale pink catalysts which were found to contain just 0.06 wt% Au. The concentration of Au removed from the catalyst was constant regardless of the length of NaCN exposure. When the cyanide leached materials were employed for benzyl alcohol oxidation under the same conditions as the unleached parent catalysts, the conversions were identical. However, when the catalytic activity was normalised to the Au content (determined by ICP analysis) the TOFs were much higher for the NaCN treated catalysts (>400,000 h⁻¹). These results clearly demonstrate that NaCN leaching is an effective route to the development of catalysts containing very low gold content, whilst maintaining high activity. The leached materials were found to comprise metallic Au nanoparticles.