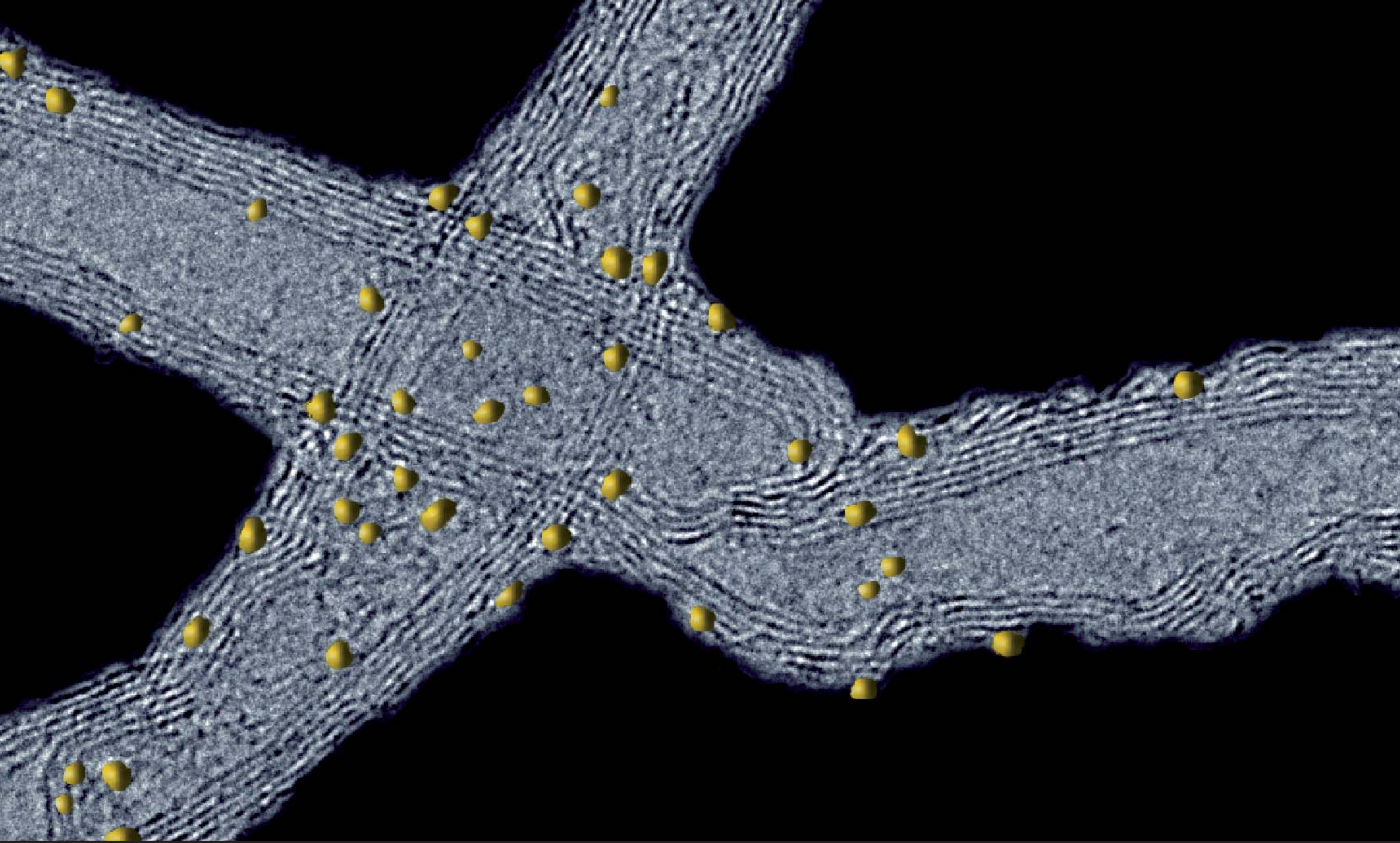

CREATING A **DIMENSION** OF INFINITE **POSSIBILITIES**

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COMMERCIAL APPLICATIONS
CATALYTIC GOLD NANOPARTICLES –
SYNTHESIS AND INDUSTRIAL APPLICATIONS

- **INDUSTRIAL CHEMISTRY**
- **EMISSIONS REDUCTIONS**
- **FUEL CELLS**

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SYNTHESIS OF GOLD NANOPARTICLES FOR CATALYSIS WO2010031890A1

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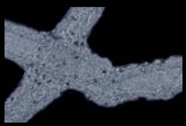

A simple method of synthesising sub-nanometric gold particles with high catalytic oxidation activity for industrial applications. The advantages of the new technology are:

- **Cost** – gold is significantly cheaper than commonly used catalysts such as platinum. Furthermore the amount of material needed to achieve optimal catalytic effect is reduced due to the narrow size distribution, ultra-fine nature of the particles and quantum size effects.
- **Catalytic Effect** – these nanoparticles have catalytic effect significantly superior to other forms of gold at both ambient and high temperatures, and rival that of traditional catalytic metals.
- **Scalability** – the production process is extremely simple and requires only standard equipment and an ambient operating environment.

BACKGROUND

Current industrial catalysts for common processes such as oxidation of vehicle exhausts, production of vinyl chloride, vinyl acetate, propyl oxide, etc, are based on expensive rare metals such as platinum. Due to high demand and low supply their cost is volatile, negatively impacting stability of pricing. Furthermore, these catalysts tend to only be effective at high temperatures, limiting their use.

The new gold nanoparticle catalyst is simple to produce, relatively low cost and price stable. It offers catalytic activity equal to or better than current products with the added advantage of room-temperature operation. Furthermore, it can be fairly easily integrated into existing products and fabrication processes, therefore requiring only minimal investment by manufacturers to convert from incumbent technologies.

The technology is currently undergoing scale-up testing. Once proven, the introduction to commercial production is straightforward with no significant prototyping required.

RESEARCH RESULTS

The technology has been proven at laboratory scale for three key processes using very small gold nanoparticles (less than 2nm in diameter) supported on carbon nanotubes:

Industrial chemistry – styrene epoxidation. Liquid phase oxidation of styrene was succesfully demonstrated.Parallel trials of larger gold nanoparticles showed no evidence of catalytic activity.

Pollutant emission reduction –room temperature oxidation of CO. Gas phase oxidation of CO to CO_2 at room temperature was successfully demonstrated. Parallel trials of larger gold nanoparticles showed no evidence of catalytic activity.

Fuel cell technology – electro-oxidation of methanol. Liquid phase electro-oxidation of methanol was successfully demonstrated.

The nanoparticles are synthesised by mixing gold precursor solution with a solution of carbon nanotubes and a reducing agent. The nanotubes were previously treated using an amine-group containing polyelectrolyte. The entire process is conducted at room temperature in air, without the need for any high temperature steps or controlled atmosphere conditions.

COMMERCIAL APPLICATIONS

This form of catalyst has a very broad range of application, in diverse industries such a chemicals, energy (traditional and renewable), environment and automotive.

Specific applications of interest include oxidation of fine chemicals such as styrene, low temperature treatment of vehicle exhausts, and electrocatalysts for methanol based fuel cells.

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