Polyaniline Electrodes Containing Tri-Atomic Au/Pd Clusters (#6451)

Hetero-tri-atomic clusters of Au1Pd2 and Au2Pd1 in a polyaniline matrix

Inventors at Georgia Tech have developed hetero-tri-atomic clusters of Au1Pd2 and Au2Pd1 in a polyaniline matrix by an atom-by-atom deposition technique. The electrochemical behavior of these novel electrodes was compared to that of macro gold/polyaniline electrodes. Their research demonstrated the high specific catalytic activity of atomic gold, which is at least three orders of magnitude higher than that of bulk gold with respect to the oxidation of alcohols. They also found that the addition of the Pt-atomic made a significant difference in the selectivity of the electrocatalyst. Finally, the researchers discovered that the order in which the metals are deposited led to the formation of different geometric isomers, and that the catalytic activity is dependent on the deposition sequence of the metal atoms. The highest activity was found for clusters where Pd and Au were deposited second and third, respectively. This research points to a substantial saving of the precious metal without the loss of catalytic activity, which is important in fuel cells and in other energy conversion device applications.

Benefits/Advantages

- More isomers – these heteroclusters have more isomers than gas phase cluster that give rise to different activities
- Cost-effective – this method is a good, cost effective way to assess the catalytic efficiency of these new atomic constructs

Potential Commercial Applications

- Electro-oxidation of various alcohols
- Alternative energy
- Energy conversion devices, electrochemical sensors, and molecular electronics

Background/Context for This Invention

The electro-catalytic oxidation of alcohols has been the subject of intense research interest due to its potential application in fuel cells. The ability to use methanol and ethanol as fuels is an important environmental, energy and security goal. The most active metals capable of catalyzing this oxidation are platinum (Pt) and gold (Au) and palladium (Pd). Polyaniline-Au electrodes are highly efficient catalysts for the oxidation of alcohols and are less susceptible to carbon monoxide poisoning.

Dr. Mira Josowicz  
Principal Research Scientist - Georgia Tech School  
Alex Jonke  
Student - Georgia Tech School of Chemistry and
For more information about this technology, please visit:
https://industry.gatech.edu/technology/polyaniline-electrodes-containing-tri-atomic-aupd-clusters