BROOKHAVEN NATIONAL LABORATORY

Palladium-Cobalt Particles As Oxygen-Reduction Electrocatalysts

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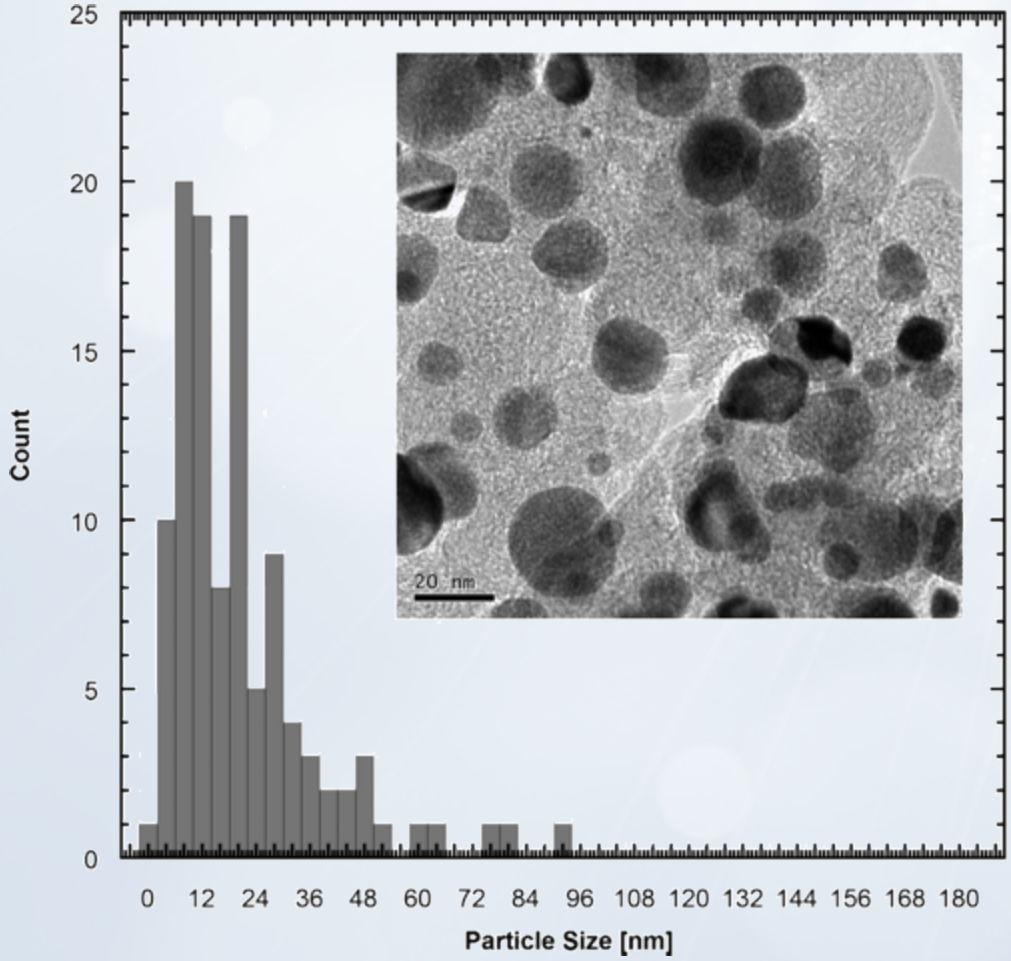
Technology Description



This TEM image shows Pd_2Co nanoparticles having a mean diameter of about 12 nm. The size distribution shows that most of the particles have diameters less than 20 nm.

Palladium-cobalt alloys formed into nanoparticles and supported on a conductor such as graphite can be used as electrocatalysts to accelerate the oxygen reduction reaction with an activity similar to that of more-expensive platinum.

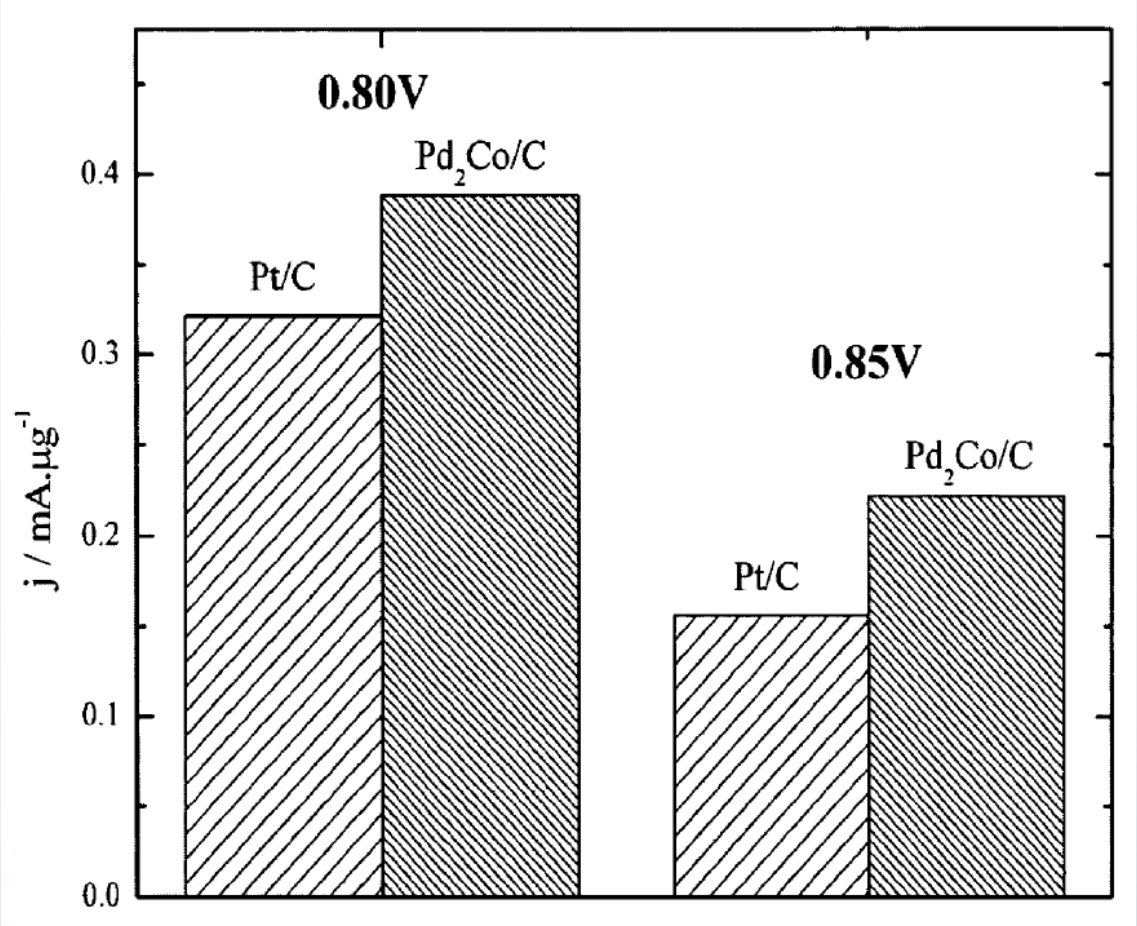
Technology Opportunity

- Palladium-cobalt nanoparticles have been fabricated and tested as cathode electrocatalysts in fuel cells.
- These nanoparticles are “drop-in” replacements for commercially available platinum electrocatalysts.
- Additional work is required to scale up the production of the alloys and to optimize compositions for specific membrane electrode assemblies.
  - Several methods exist to form the nanoparticles, including electrochemical methods which are easily scalable.
  - The addition of other transition metals can be used to balance cost with catalytic activity.

Technology Leadership

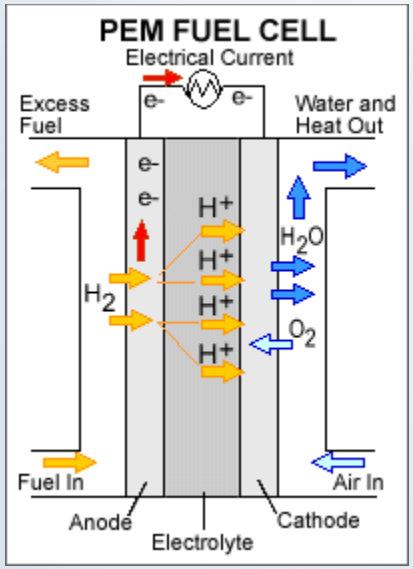
This plot shows that the catalytic activity per gram of precious metal is higher for the palladium-cobalt alloys than for pure platinum.

In addition, palladium is trading at about 40% of the price of platinum.



Applications – Target Customers – Current Practice

Application	Target Customers	Current Practice
Fuel cell cathodes	Catalyst manufacturers Fuel cell manufacturers	Platinum on Carbon
Heterogeneous catalysis	Catalyst manufacturers Petrochemical companies	Platinum



Revenue and Profit Potential

- Prices
  - Other low-platinum catalysts sell for US$4,000-$5,000 per 100 g.
    - It is not clear how much platinum is contained in these catalysts.
- Costs
  - Platinum trades near $1475 per troy ounce (30 grams).
  - Palladium is trading around $580 / troy ounce.
  - Cobalt costs less that $15 / ***pound***.

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