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(Adapted from Dilbert
March 9, 09)



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The Problem Statement

The duality of the U.S. economy



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The Upside

Which country is the world's top manufacturer?

The United States....

\$1.6T in '07.... nearly double '87 (\$811B)....

For every \$1 produced in China.....U.S. generates \$2.50.....

(Associated Press, Feb. 16, 09)



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The Upside

U.S. manufacturing is moving “upscale...”

**Driven by maximizing profit and
efficiency.....**

**Transition to high-end products as production
of low-value goods moves overseas....**

(Associated Press, Feb. 16, 09)



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The Downside

“...building more and more stores to sell more and more stuff...”

**“...made in more and more factories...
in China...”**

“...powered by more and more coal...”

**“...that would cause more and more climate
change...”**

(Thomas L. Friedman,
NY Times, March 8, 09)



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The Downside

“...and earn China more and more dollars to buy more and more U.S. T-bills...”

“...to have more and more money to build more and more stores and sell more and more stuff...”

“...and employ more and more Chinese...”

**(Thomas L. Friedman,
NY Times, March 8, 09)**



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The Net Result

”...The Inflection Point Is Near...”

“...must transition to concept of net-zero...”

**“...buildings, cars, factories and homes
designed to generate as much energy as
they use...”**

**(Thomas L. Friedman,
NY Times, March 8, 09)**



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Why the Nanoelectronics Industry?

**....A necessary enabler and driver
for any effective green energy strategy....**

The three “...tion”s



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Then lightning strikes...!

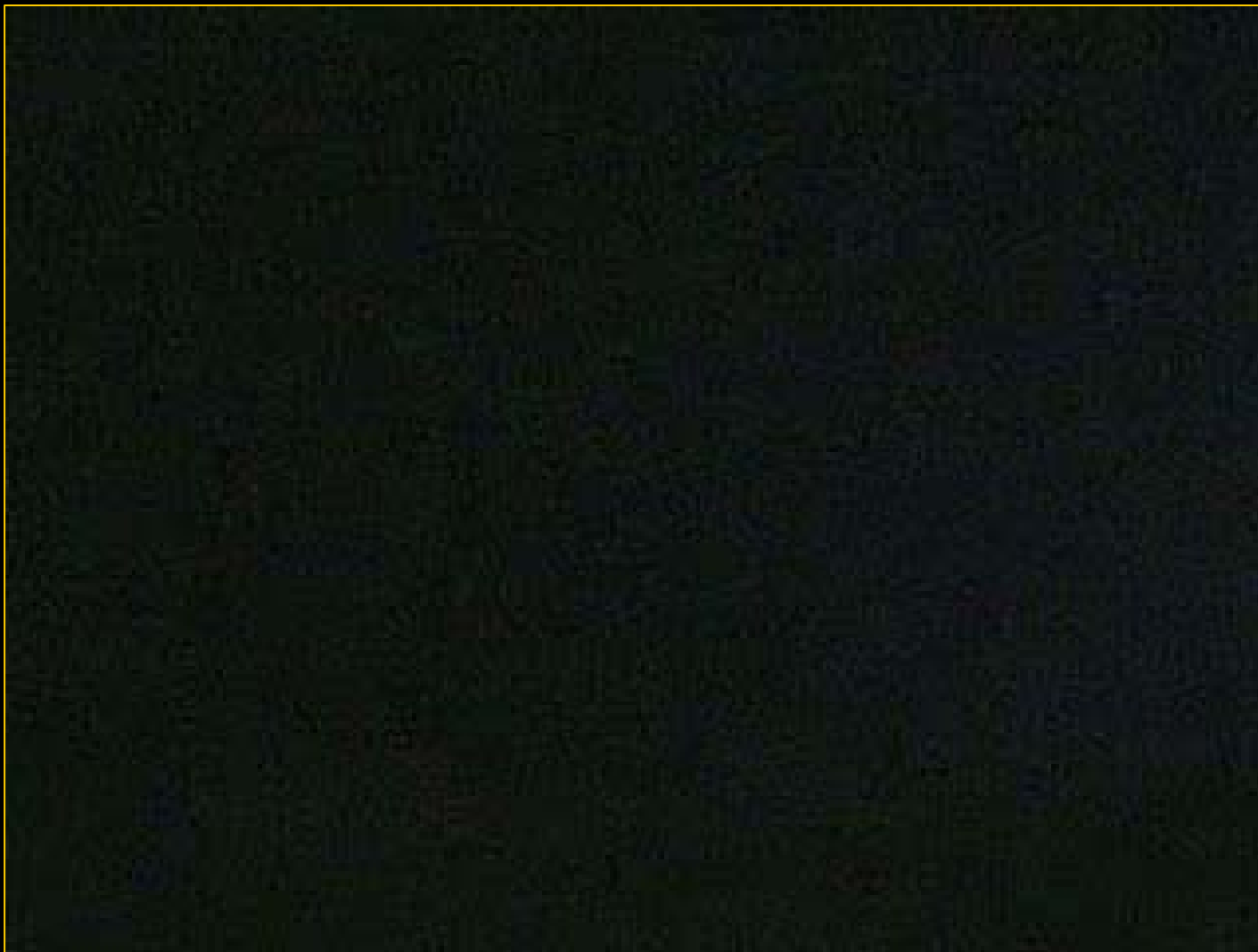




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Repeatedly.....





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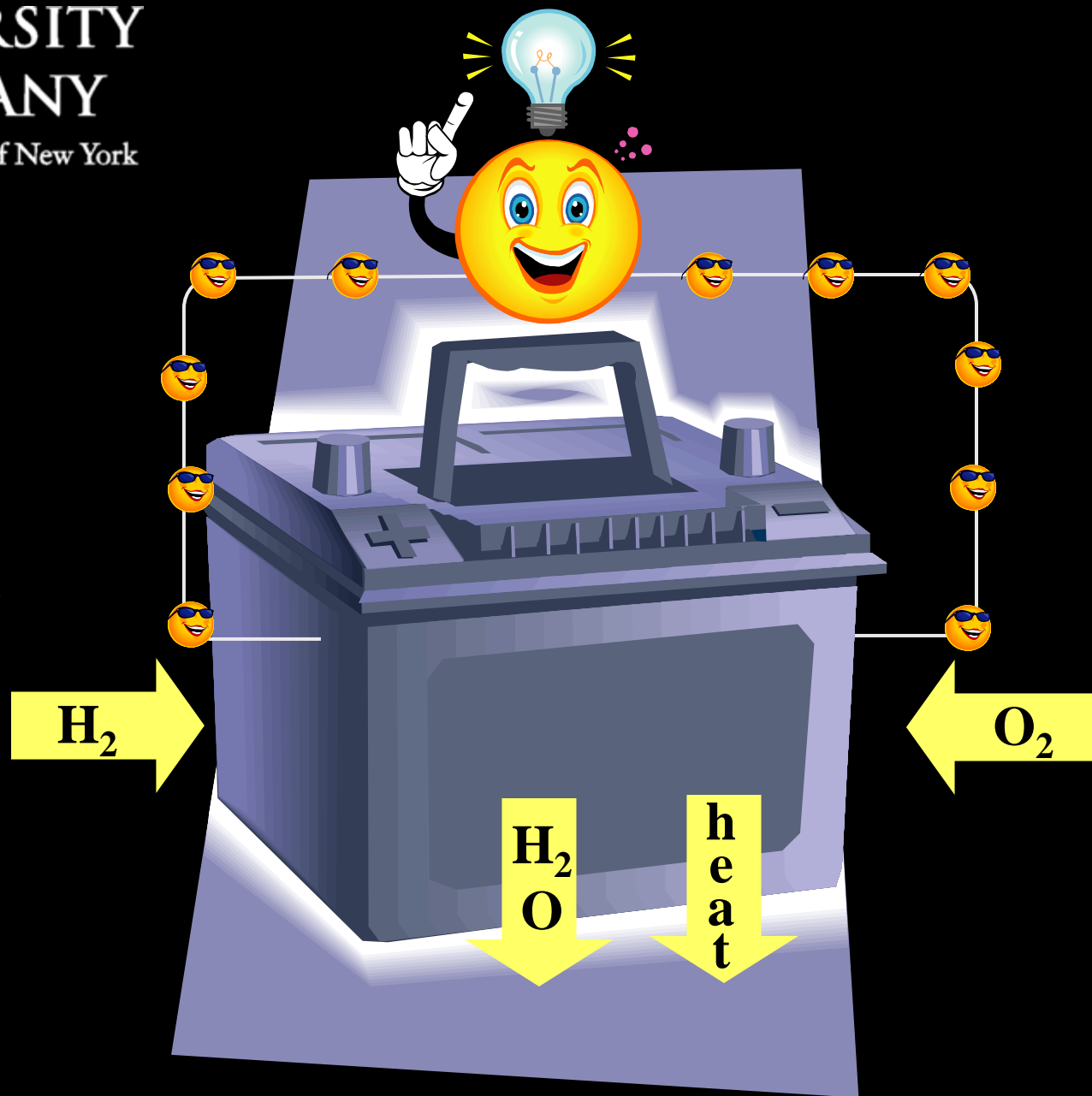
Innovation

**Integration of nanotechnology know how
in renewable energy technologies**



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Fuel Cell. Basic Operation

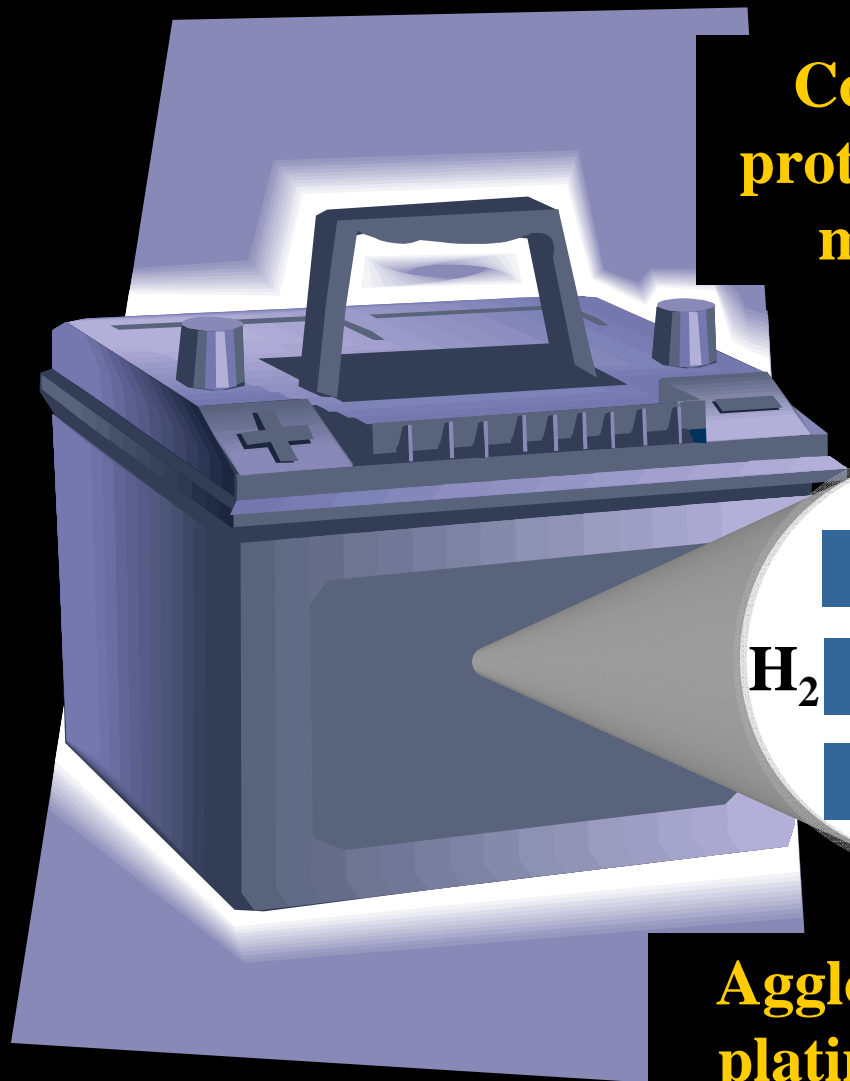




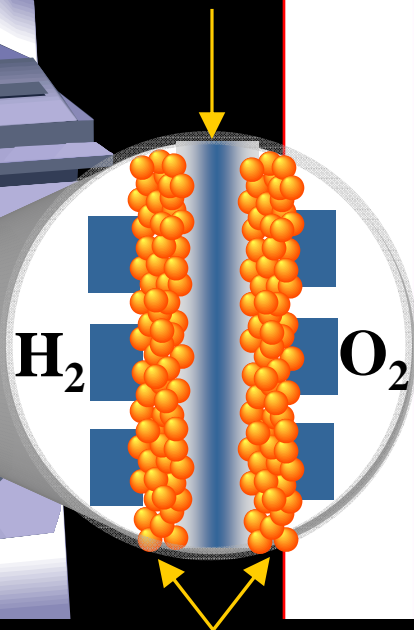
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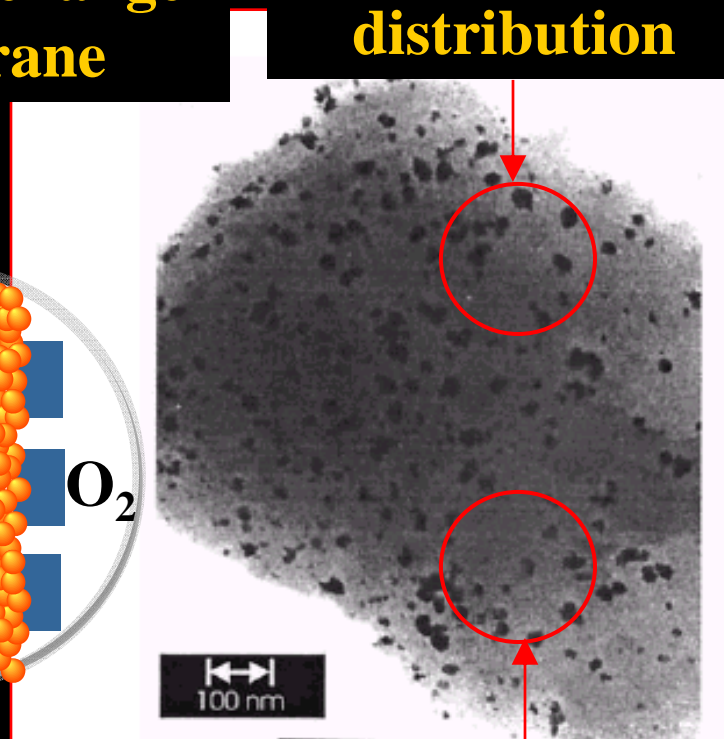
Fuel Cell Challenges



**Corrosion of
proton exchange
membrane**



**Poor Platinum
distribution**



**Agglomeration of
platinum catalyst**

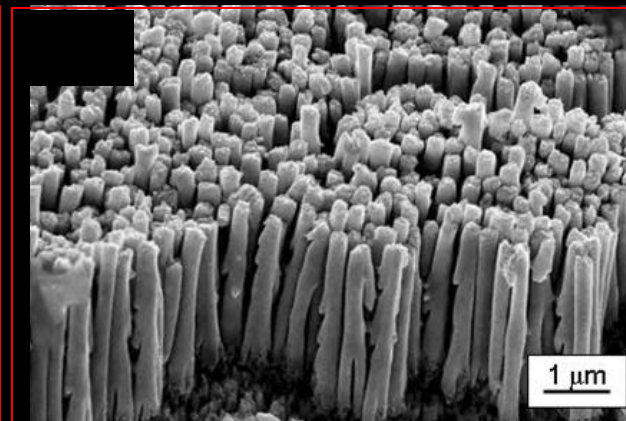
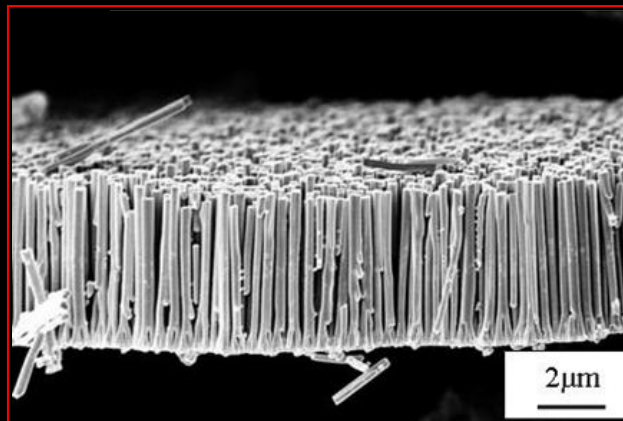
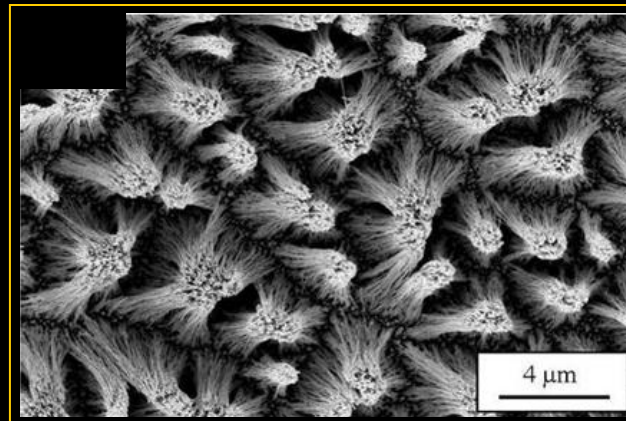
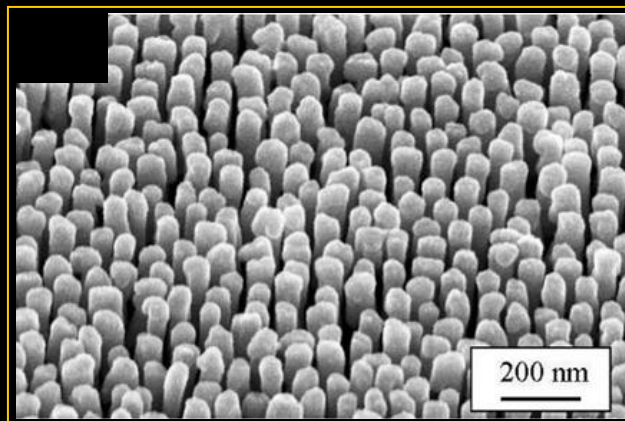
**Low Platinum
density**



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Fuel Cell. Nanotechnology to the Rescue

**Highly
Dense
Platinum
Nanorods**



Potential enabler for uniformity, reliability, and reaction efficiency

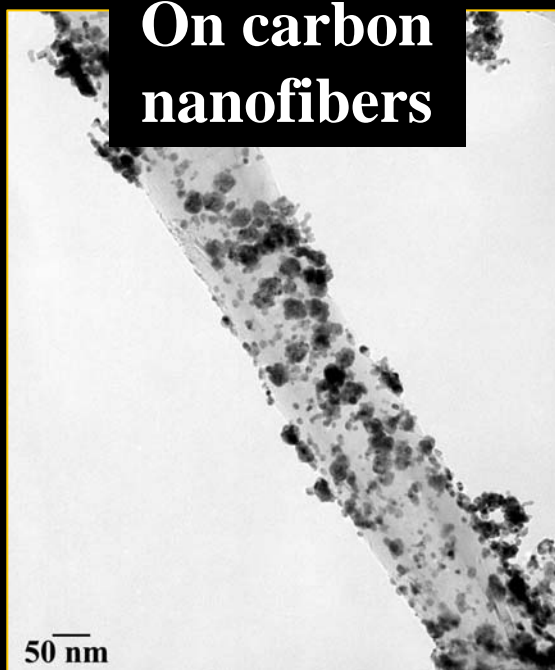


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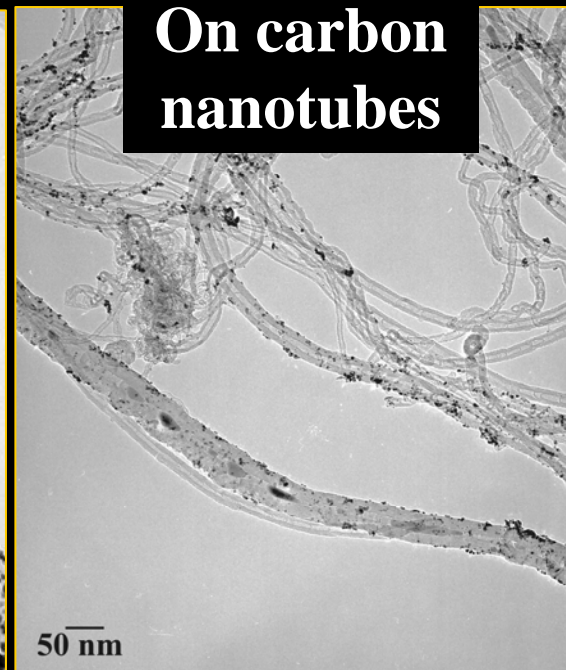
Fuel Cell. Nanotechnology to the Rescue

**Atomically
engineered
platinum
nanoparticles**

**On carbon
nanofibers**



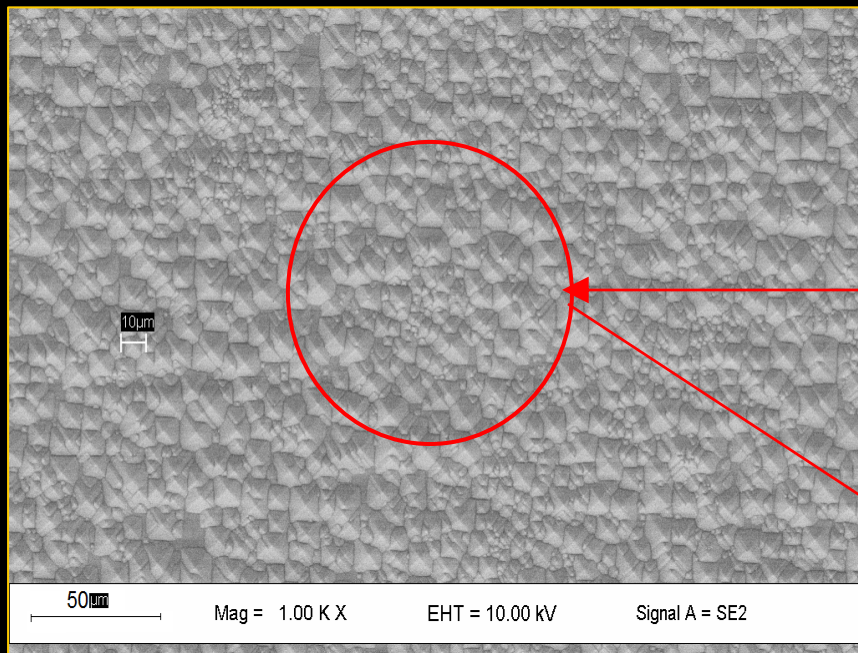
**On carbon
nanotubes**



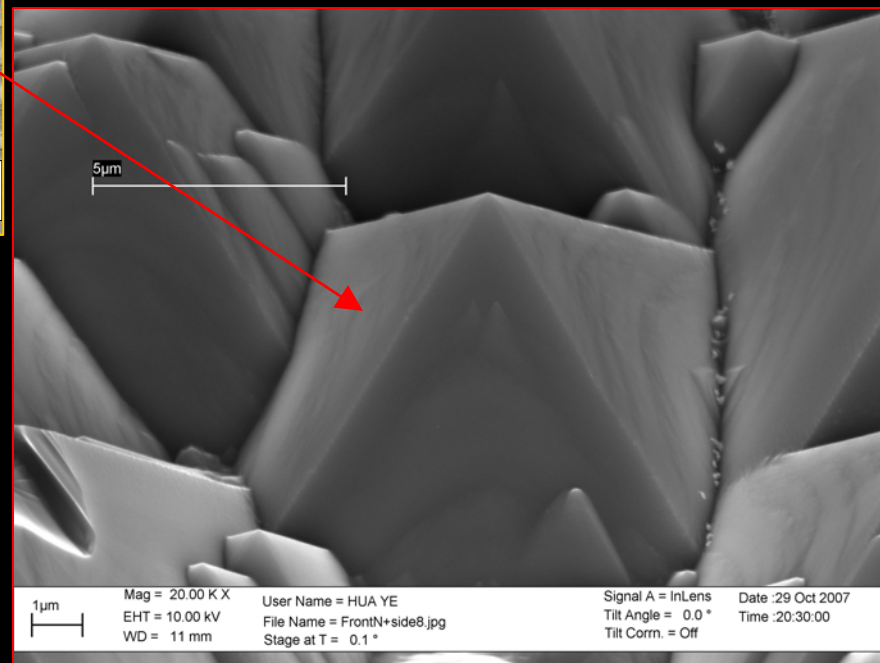
**Uniform and dense platinum
nanoparticle distribution
maximizes surface area and
thus reaction efficiency**



Solar Cell. Nanotechnology to the Rescue



**Structural
micromodulation
of silicon surface
morphology**



**Maximizes light scattering
within Si crystals and,
potentially, photovoltaic
conversion efficiency**



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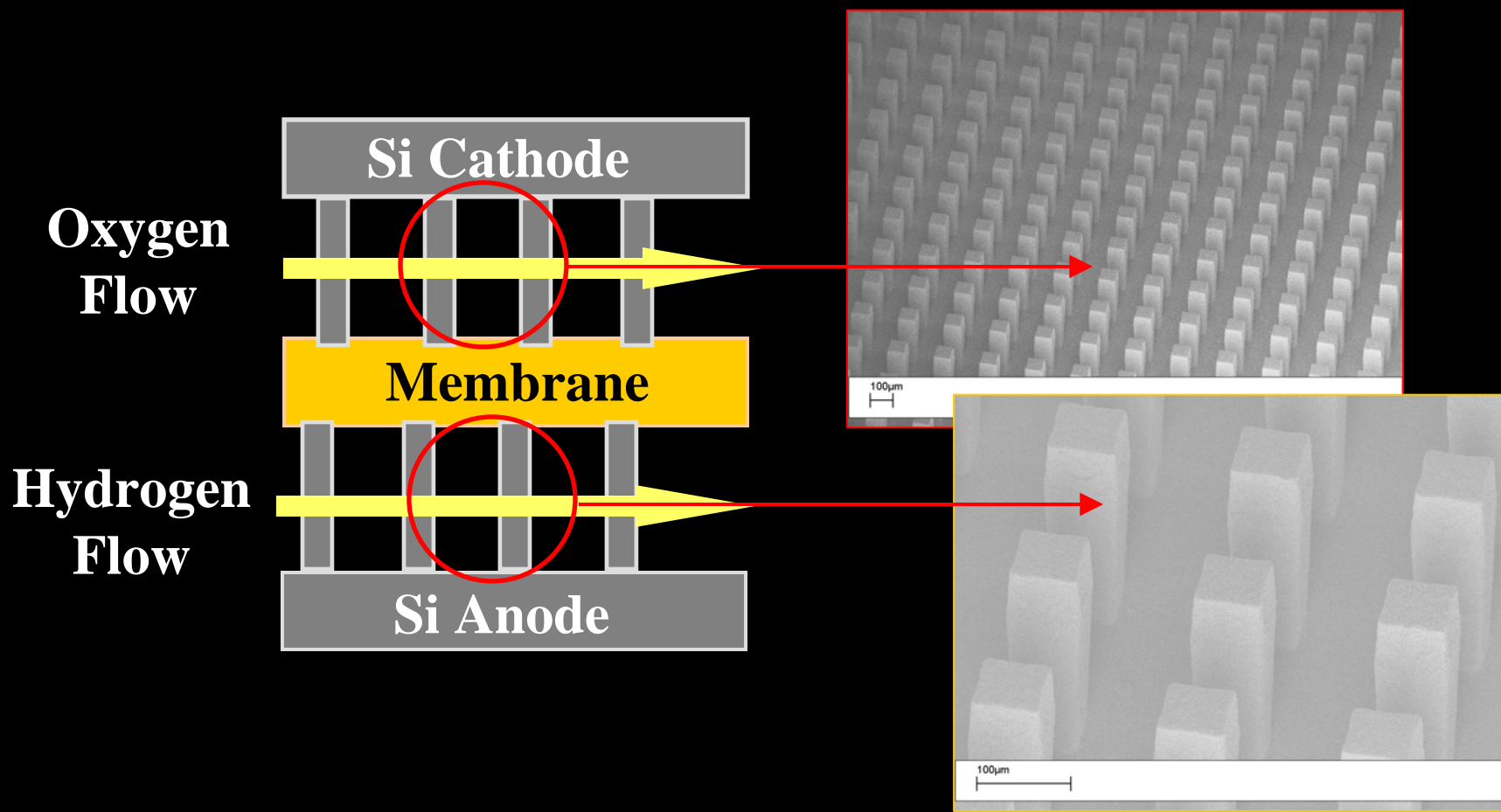
Automation

**Use of nanoelectronics processing protocols
in manufacturing of energy products**



Fuel Cell. Lithography Based Fabrication

Computer chip design and lithography know how enables reliable and reproducible manufacturing of fuel cell electrode assemblies





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Reliability

Denmark



“....PSC probes wind tower collapse, fire....”
(Times Union, March 12, 2009)



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Collaboration

Application of the nanoelectronics burden-sharing “Arcropolis” model to energy R&D and commercialization



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\$100M Zero Energy Nano- technology (ZEN) Building

**First zero energy living test
bed in U.S. for nanoscale
renewable energies**

**Modular integration of
component, system, and
facility energy solutions**



**First burden-sharing
energy technology and
business “Acropolis”**

**zero-energy design, testing
and construction
methodologies**

College of Nanoscale Science and Engineering



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