



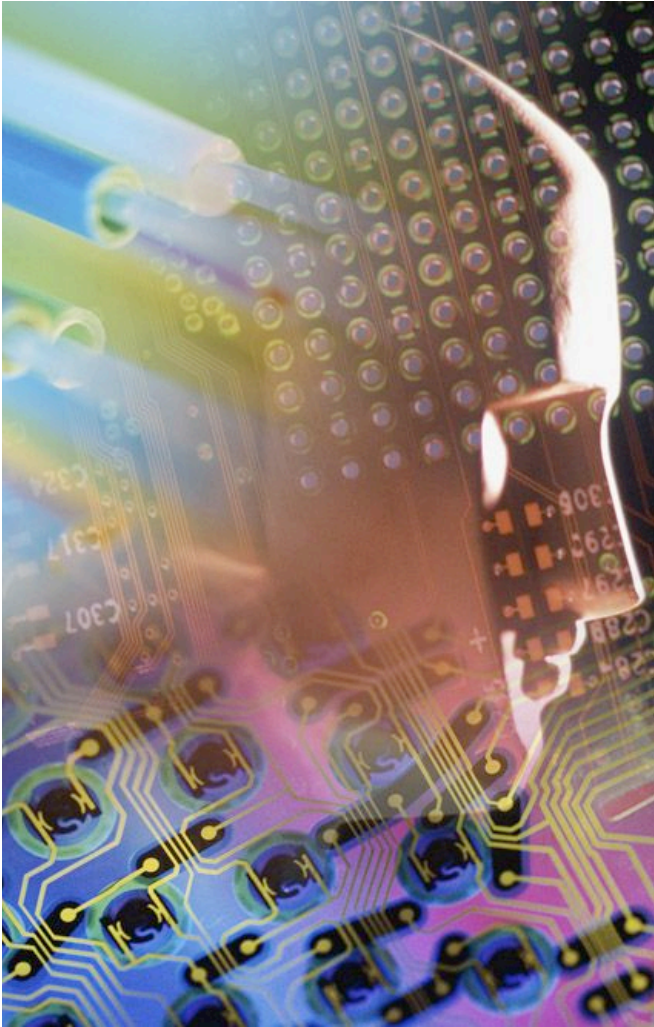
Nanotechnologies for the Electric Power Industry

**Advancing Beneficial Nanotechnology:
Focusing on the Cutting Edge**

13th Foresight Conference

October 24-25, 2005

Clark Gellings,
Vice President – Innovation
Electric Power Research Institute



Electric Power Industry Challenges



The Ten Key Innovation Challenges

1. Power delivery asset management
2. Grid control
3. Distributed energy resources
4. Power quality
5. Electricity markets
6. Consumer connectivity
7. End use energy efficiency
8. Coal fleet for tomorrow
9. Security
10. Generation IV nuclear plants

Candidate Nanotechnologies

Photovoltaics

- Unique structures at the nanoscale

Thermoelectrics

- Eight times the conversion effect

Sensors

- Combustion process
- pH measurement
- Voltage & current
- Dissolved gases

Structural Materials

- Fly wheels
- Advanced conductors

Fuel Cells & NOx

- Lower cost catalysts
- High operating temperature materials

Magmolecules

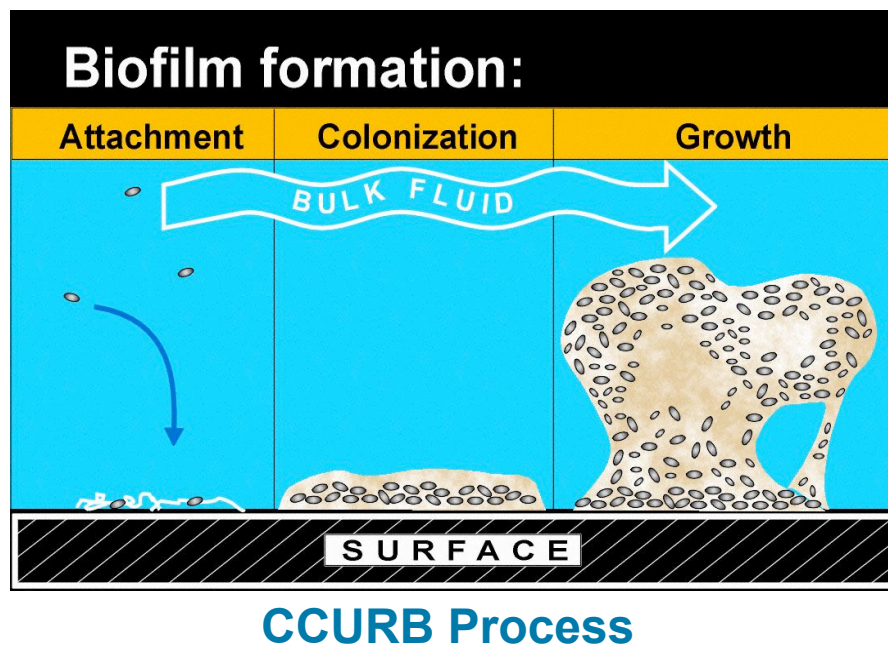
- Developing a process utilizing **magmolecules** to selectively remove nuclides from liquid LLW streams with a high-volume reduction factor.
- Developed magmolecules are broad-based in binding capability. Methods are now being developed for the selective removal of Co, Cs, Sb, and Se; all contaminants of interest.

Ferritin

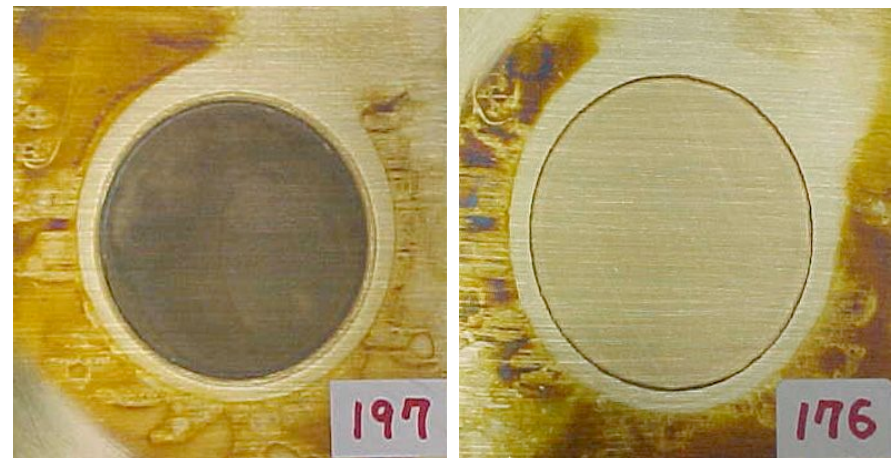
- **Naturally occurring (Human Iron Storage Protein)**
- **Small size (12nm diameter)**
- **Can add magnetic cores**



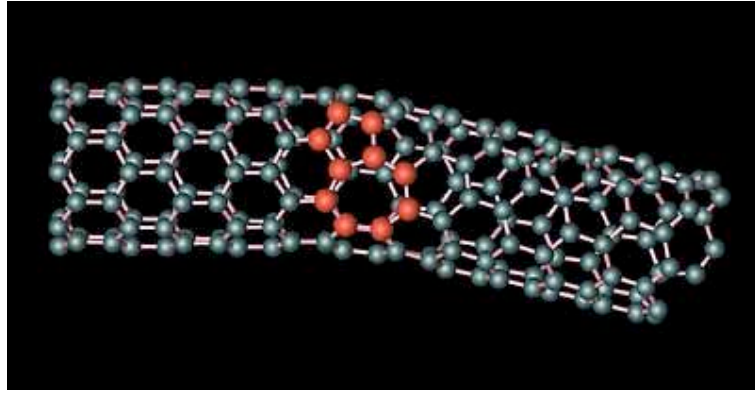
Corrosion Control Using Regenerative Biofilms (CCURB)



- Control corrosion in open recirculating tower systems (service waters, fire protection, etc.)
- Protects against both MIC and abiotic corrosion
- Demonstrated successful test loop at TMI



Ultracapacitors



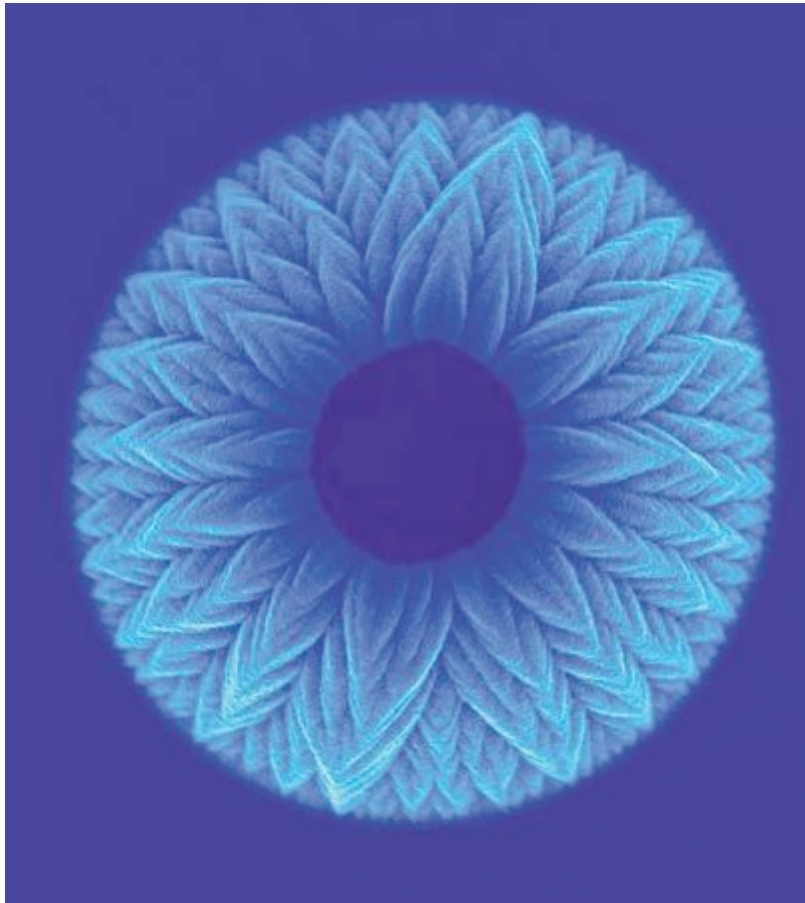
Wikipedia.org

Carbon nanotube

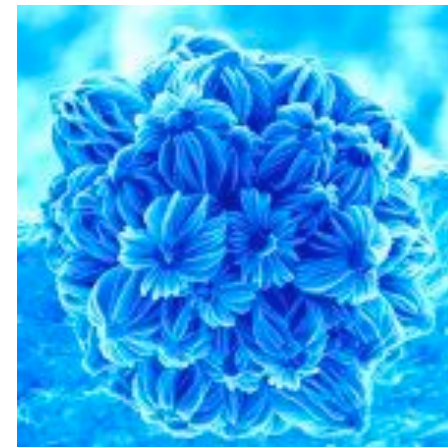


- Evaluating use of carbon nanotubes in ultracapacitors
 - Up to 1000x more effective in storing energy
- Potential benefits
 - Cost-effective materials for FACTS and power quality applications
 - *Very* long cycle life (10s of million cycles)

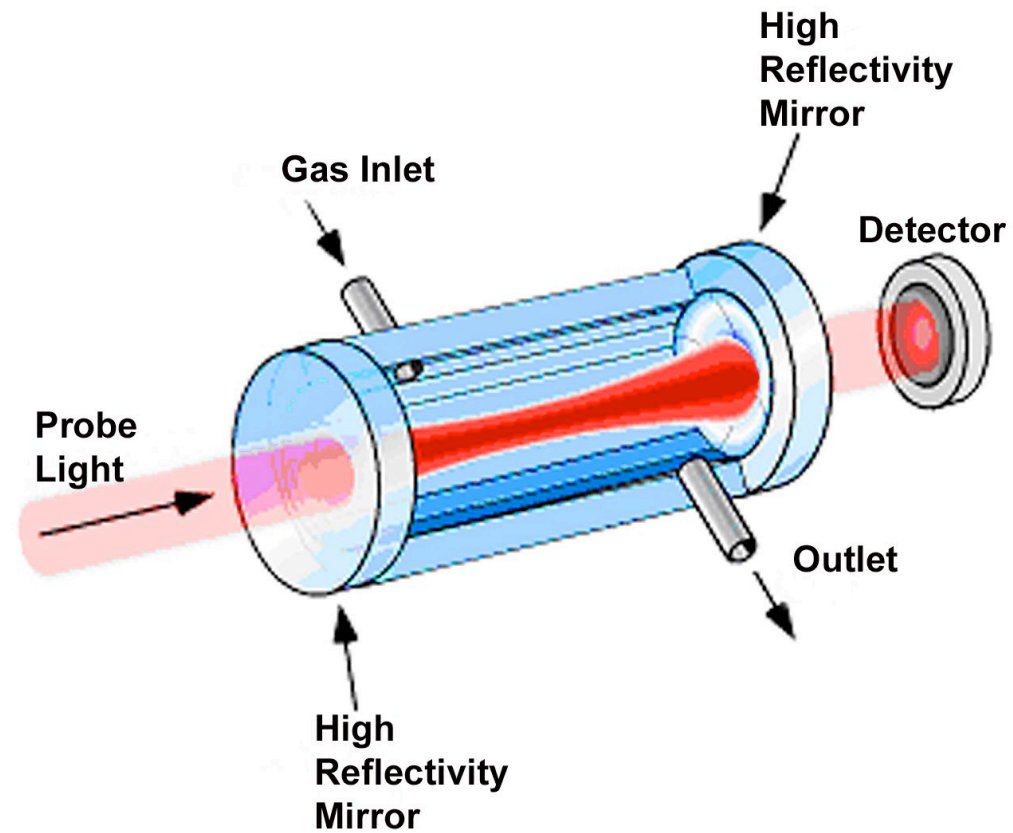
Nanotechnologies



- Silicon Carbide Nanoflower and Nanobouquet
- Strongly repels water
- Useful as a waterproof coating and a base for advanced solar cells



Optical Nose

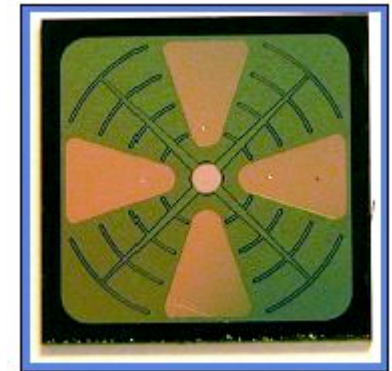
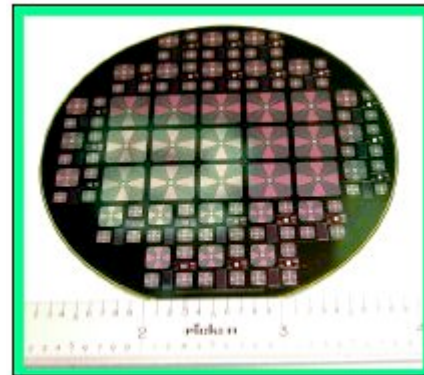


Source: NIST

Large Area SiC Switch



Advanced Power Electronics



- 1 cm²
- 1750 V; 250 Amps @ 250°C
- Milestone in power & size for high-power applications

Contact information

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