Discussion Notes

Workshop on Passive Photocatalytic Oxidation

Lawrence Berkeley National Laboratory

June 29, 2007

Material deployment options

- Cement-concrete walls, roads, …
- Asphalt-concrete pavements
- Polymer coatings
- Transparent window coatings
- Coated roof granules

Material design

- Catalyst particles must be very small
- Material must be porous
- Ideally, catalyst support is UV-transparent
- Matrix may need to capture/hold unwanted intermediate products
- Include additives to assist with catalyst regeneration?

NO_x reaction rates

- Experimental estimates are on the order of 10-100 mg per m^2 per day
- Available UV photon fluxes suggest higher performance may be attainable

Some issues related to passive PCO deployment

- What are the current levels of all the important pollutants and how will each be changed by PCO deployment?
- What are the most undesirable side products? Can they be avoided?

Durability

- Must be demonstrated in multi-year experiments
- Japanese and European results promising
- Dry California summers may impair catalyst regeneration by rainfall

Cost

- Source control of NO_x costs roughly $2,000 - $10,000 per metric ton
- PCO needs to be cost-competitive
- Can other benefits of PCO make it more cost-effective (e.g., self-cleaning glass)?

Patents

- Large numbers of patents complicate the acquisition of intellectual property
- Japanese firm TOTO, Inc. receives several million dollars yearly in royalties

Standards

- Technology users need quality assurance
- Industry needs to agree on standard test methods
  - Simple and inexpensive
- Right now complex laboratory testing is necessary for performance evaluation
- Committees in Japan and Europe are working on this issue

A program for California (i)
(presumes ongoing basic research)

1. Applied research
   - System design including catalyst support
   - Experimental catalyst characterization
   - Effects of incomplete oxidation
   - Catalyst lifetime and regeneration
   - Additional technical issues that arise
2. Mathematical modeling, to reduce number of expensive large-scale experiments
   - Theoretical analysis of experimental data as functions of temperature, uv flux, reactant concentrations, etc.
   - Local modeling
   - Regional modeling

A program for California (ii)

3. Demonstrations
   - Small scale (a roof, a wall, a road)
   - Large scale (a city block)
4. Market development and implementation
   - Industrial collaboration with the state
   - Policy issues
   - Regional standards and codes
   - Analysis of regional credits