

TITLE: CO₂ Sequestration and Recycle by Photosynthesis

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ABSTRACT

OBJECTIVE(s): The objective of this study is to develop highly active catalysts for photo-reduction of CO₂ and H₂O to methane and methanol.

ACCOMPLISHMENTS TO DATE:

- Design and construction of the in situ infrared photocatalytic reactor cell.
- Determination of the effectiveness of TiO₂-supported Cu, Pd, Pt catalysts for photosynthesis and photocatalytic oxidation.
- Elucidation of the reaction mechanism of photosynthesis and oxidation.
- Determination of the factors controlling the photosynthesis of hydrocarbons.

FUTURE WORK:

- Optimize the performance of photosynthesis by adjusting the anode catalyst composition.
- Perform economic analysis of the photosynthesis process.

**LIST OF PAPER PUBLISHED, U.S. PATENT/PATENT APPLICATIN(S),
CONFERENCE PRESENTATIONS, STUDENTS SUPPORTED UNDER THIS GRANT**

Conference Presentations

- “Photo-catalytic Conversion of CO₂/H₂O to Hydrocarbons and Oxygenates,” Invited Talk, First Ohio CO₂ Reduction, Capture & Sequestration Forum, Horace B. Collins Laboratory, Delaware, Ohio, March 23, 2001.
- “Photosynthesis of CH₃OH/CH₄ from CO₂/H₂O,” Graduate Seminar, Chemistry, Kent State University, Feb. 14, 2002.
- “Photocatalysis: Conversion of CO₂/H₂O to Hydrocarbons and Oxygenates,” Invited Talk, W. R. Grace, Aug 16, 2003.
- P. Toochinda, ”Palladium and Copper: Environmentally Benign Catalysts for Oxidative Carbonylation and Photocatalysis,” Dissertation, University of Akron, 2003.
- “Photocatalytic Synthesis of Hydrocarbons from CO₂ and H₂O,” manuscript in preparation.

Students Supported Under the Grant

- Dustin Donelly, undergraduate student in the Chemical Engineering Department, The University of Akron. 2004
- P. Toochinda, received Ph.D. in 2003.
- Zhiqiang Yu, Ph.D. student in the Chemical Engineering Department, The University of Akron.