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Augmentation for Research Training: Surface-Mediated Photocatalysis

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6. AUTHOR(S)

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The view, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

12a. DISTRIBUTION/AVAILABILITY STATEMENT

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12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

Photocatalytic oxidation on irradiated semiconductor surfaces is a useful route for degradation of various organic materials under constrained, highly controlled conditions. Seven manuscripts acknowledging Army Research Office support have been produced with support from this grant. Two American citizens have received Ph.D. degrees, and two other American citizens are currently working on Ph.D. degrees. Two undergraduate students also worked on this project.

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"Augmentation for Research Training: Surface-Mediated Photocatalysis"

Final Report

Date Submitted: June 1, 1994

ARO Proposal No. 29548-CH-AAS

Work from 1/5/92 to 30/4/94

Grant No. DAAL03-92-G-0089

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Statement of Work:

Three areas have been investigated: (1) application of esr spectroscopy and time-resolved diffuse reflectance absorption and emission spectroscopy to establish mechanisms in photocatalytic oxidative degradations of organic molecules; (2) exploration of controlled oxidation chemistry for new heteroatom-containing organic molecules; and (3) synthesis and characterization of new quantized semiconductor-support systems.

Summary of Most Important Results:

The objectives of this project have been largely accomplished despite discontinued funding of the parent grant beyond the initial nine months, instead of the requested three years. We have successfully demonstrated that photocatalytic oxidation on irradiated semiconductor surfaces is a useful route for degradation of various organic materials under constrained, highly controlled conditions. Several projects begun and submitted for publication under the parent grant were revised and have appeared during this period. Two American citizens have been awarded Ph.D. degrees for work supported by the AASERT grant: Maria Dulay, who currently holds an NIH postdoctoral fellowship with Richard Zare at Stanford University, and David T. Breslin, who currently holds a postdoctoral appointment with Grant Willson at the University of Texas and will accept a similar position in July with Gary B. Schuster at the University of Illinois.

List of All Publications and Technical Reports:

"Photodegradation of Benzamide in TiO₂ Aqueous Suspensions," Catherine Maillard, Chantal Guillard, Pierre Pichat, and Marye Anne Fox, *New J. Chem.* 1992, 16, 821.

"Cadmium Benzenethiolate Clusters of Various Size: Molecular Models for Metal Chalcogenide Semiconductors," Thomas Türk, Ute Resch, Marye Anne Fox, and Arnd Vogler, *J. Phys. Chem.* 1992, *J. Phys. Chem.* 1992, 96, 3818.

"Spectroscopic Studies of Zinc Benzenethiolate Complexes: Electron Transfer to Methyl Viologen," Thomas Türk, Ute Resch, Marye Anne Fox, and Arnd Vogler, *Inorg. Chem.* 1992, 31, 1854.

"Molecular Models for Semiconductor Particles: Luminescence Studies of Several Inorganic Anionic Clusters," Thomas Türk, Arnd Vogler, and Marye Anne Fox, *Amer. Chem. Soc. Adv. Chem. Ser.* 1993, 238, 233.

"Heterogeneous Photocatalysis," Marye Anne Fox and Maria T. Dulay, *Chem. Rev.* 1993, 93, 341.

"Degradation of Organophosphonic Acids Catalyzed by Irradiated Titanium Dioxide," Kevin W. Krosley, David M. Collard, Jennifer Adamson, and Marye Anne Fox, *J. Photochem. Photobiol. A*, 1993, 69, 357.

"Competitive Photooxidative Degradation of Amines and Alcohols on Heterogeneously Suspended TiO₂ Particles," Marye Anne Fox, Shiyamalie Ruberu, Andrew Hadd, and Young-Soo Kim, *Proc. Electrochem. Soc.* 1993, 93-18, 104.

List of Participating Scientific Personnel and Degrees Obtained:

Maria Dulay and David Breslin: graduate students who received Ph.D.s in 1994

Gina Stewart and Waymon Harrell: current graduate students

Undergraduate students: Jennifer Adamson, Andrew Hadd

Reportable Inventions: None