

BIOGRAPHICAL SKETCH

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a. Professional Preparation

Oxford University (chemistry)	B.A.	1955
M.I.T. (chemical engineering practice)	S.M.	1957
M.I.T. (chemical engineering, advisor H.C. Hottel)	Sc.D.	1962

b. Professional Appointments

Instructor, Chemical Engineering, MIT, 1958, 1960
Assistant Professor, Chemical Engineering, MIT, 1961-1967
Associate Professor, Chemical Engineering, MIT, 1967-1972
Professor, Chemical Engineering, MIT, 1972 - 1996, Emeritus 1996-
Visiting Professor, Chemical Engineering and Fuel Science, Sheffield University, England, Spring 1971
Visiting Scientist, C. N. R. Combustion Research Laboratory, University of Naples, Italy, Spring 1974
Visiting Chevron Energy Professor, California Institute of Technology, Winter 1979
Joseph R. Mares Professor, Chemical Engineering, MIT, 1981-1984
Visiting Professor, University of Naples, Italy, Spring 1983
Lamot du Pont Professor of Chemical Engineering, MIT, 1989 - 1996, Emeritus 1996-
Presidential Professor, University of Utah, 1997-
Senior Technical Advisor, Reaction Engineering International, 1996-

c.1 Five publications of most relevance to this proposal

"Soot Surface Growth by Polycyclic Aromatic Hydrocarbon and Acetylene Addition," S. Macadam, J. M. Beer, A. F. Sarofim, A. B. Hoffmann, 26th International Symposium on Combustion Part 2, 2: Napoli, 1996.
"Effects of Pyrene Pyrolysis Product Distributions at High-Temperatures", J.A. Mulholland, J. Mukherjee, A. F. Sarofim, *Energy & Fuel*, **11(2)**:392-395, 1997.
"Quantum Molecular Study of Molecular Weight Growth Process", A. Violi, T. N. Truong, A. F. Sarofim, *Combustion and Flame*, **126**: 1506-1515, 2001.
"C-13 NMR Analysis of Soot Produced from Model Compounds and a Coal", M. S. Solum, A. F. Sarofim, R. J. Pugmire, T. H. Fletcher, H. Zhang, *Energy and Fuels*, **15**, 961-971, 2001.
"Inorganic Aerosols and Their Role in Catalyzing Sulfuric Acid Production in Furnaces," A. K. Graham, A. F. Sarofim, *Journal of the Air & Waste Mang. Assoc.*, **48(2)**:106-112, 1998.

c.2 Five additional significant publications

"Measurement of Oxygenated Polycyclic Aromatic Hydrocarbons Associated With a Size-Segregated Urban Aerosol," J. O. Allen, N. M. Dookerman, K. Taghizadeh, A. L. Lafleur, K. A. Smith, A. F. Sarofim, *Env. Sci. and Tech.*, **31(7)**: 2064-2070, 1997.
"Application of High-Resolution Electron Microscopy for the Characterization and Source Assignment of Diesel Particulates," with L. C. Rainey, A. B. Palotás, P. Bolsaitis and J. B. Vander Sande, *Appl Occupational and Environ Hygiene* **11(7)**: 777-781, 1996.
"Where Did That Soot Come From?," A. B. Palotas, L. C. Rainey, A. F. Sarofim, R. C. Flagan, *ChemTech*, **28(7)**: pp24, 1998.
"Biarene Formation During Pyrolysis of a Mixture of Anthracene and Naphthalene," with M. C. Masonjones and A. L. Lafleur, *Combust.Sci and Tech*, **109**: 273-285, 1995.
"High Temperature Pyrolysis of o-terphenyl: Evidence for Kinetic Control in the Benzene Polymerization Pathway and Importance of Arene Aggregation/Condensation Reactions in the Formation of Polycyclic Aromatic Hydrocarbons," M. C. Masonjones, J. Mukherjee, A. F. Sarofim, K. Taghizadeh and A. L. Lafleur, *Polycyclic Aromat.* **8**:229-242, 1996

d. Synergistic Activities

Member of the National Research Council Review Team for the Building and Fire Research Program at the National Institute of Standards. Member of the Industrial Advisory Committee for the Department of Chemical and Environmental Engineering at the University of Arizona.

e.1 Collaborations & Other Affiliations

Prof. R. Pugmire (University of Utah), Dr. A. Violi (University of Utah), Prof. J.S. Lighty (University of Utah), Prof. Eric Eddings (University of Utah), Prof. E. Ranzi (Polytechnic of Milan, Italy), Prof. T.N. Truong (University of Utah), Dr. Westbrook (Lawrence Livermore National Laboratory), Prof. D'Anna (U. of Naples, Italy), Prof. D'Alessio (U. of Naples, Italy).

e.2 Graduate Advisor:

Hoyt C. Hottel, M.I.T. (deceased).

e.3 Thesis Advisor and Postgraduate-Scholar Sponsor within the last 5 years

Thesis Advisor: Alejandro Molina, now at Sandia Combustion Research Facility (currently co-advising 4 students). Postdoctoral Associate: Angela Violi, (2000-2002), now Research Associate at the University of Utah, (Currently co-advising 1 post doctoral fellows).

Honors and Awards

Sir Alfred Egerton Gold Medal, The Combustion Institute; 1984, Kuwait Prize for Petrochemical Engineering, 1983; Walter Ahlström Prize, The Finnish Academies of Technology, 1993; Homer H. Lowry Award in Fossil Energy, Department of Energy, 1996; Percy Nicholls Award, American Society of Mechanical Engineers Fuels and Combustion Technology Division, 1996; Lawrence K. Cecil Award, Environmental Division, American Institute of Chemical Engineers, 1998; Doctorate in Chemical Engineering, Honoris Causa, University of Naples "Federico II", 1998; Energy Systems Award, American Institute of Aeronautics and Astronautics, 2000; Member, National Academy of Engineers, 2003; George Westinghouse Gold Medal, ASME, 2004..

Results of Prior NSF Support

1. NIRT- Investigating Nano-carbon Particles in the Atmosphere: Formation and Transformation (NSF award number EEC-0304422, start date 9/15/03). External collaborators on this project, are Drs. Andrea D'Anna and Dr. Antonio D'Alessio in the Department of Chemical Engineering at the University of Naples. They are providing information on the formation of nanoparticles, their optical constants, molecular weight distribution obtained using size-exclusion chromatography, and aspect ratio using atomic force microscopy. They also, through their contacts with the CNR Istituto Motori will provide information on the optical properties and the size distribution of diesels of both conventional and advanced (using the common-rail technology for time programmed injection) technologies. The results to date show that young soot particles are non-spherical and are non-absorbing in qualitative agreement with our modeling.
2. CRAEMS: Molecular Structure and Microstructure of PM_{2.5} Derived from Stationary and Mobile Fossil Fuel Sources. This NSF program, funded in 09/00, utilizes a variety of diagnostic techniques to study soot and fly ash from laboratory and pilot scale combustors at the University of Kentucky, University of Utah and University of Missouri-Rolla. These have identified the structure of soot precursors, free radicals in both tar and soot residues, and the distribution of trace metals in soots and coal fly. The results have been used to support mechanistic studies. The structure and free radical content of the soot from well-defined laboratory flames have been used to support a polymerization model for soot formation. The studies on diesel engines, with and without ferrocene additives have shown how the dispersion of iron in soot underlines its role as an oxidation catalyst. The distribution of arsenic and chromium in fly ash from laboratory scale combustors shows the importance of their interaction with calcium salts in determining their partitioning between fines and residues and also their chemical state.