

Appendix I

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Arthur A. Krawetz  
1010 Isabella Street  
Evanston, Illinois  
U.S. Citizen  
Born-Chicago, Illinois, 30 October, 1932

Accreditation and Certification:

Chartered Scientist, Csci (Royal Society of Chemistry,  
London, England)  
Chartered Chemist, FRSC (Royal Society of Chemistry,  
London, England)

Education Background:

Northwestern University, B.S., 1952  
Chemistry Major, Physics and Mathematics Minor  
University of Chicago, M.S., 1953  
Physical Chemistry Major  
University of Chicago, PhD, 1955  
Physical Chemistry Major

Academic Honors:

Phi Beta Kappa  
Sigma Xi  
Phi Lambda Upsilon  
Pi Mu Epsilon

Other Honors:

ASTM Committee D-2 on  
Petroleum Products and  
Lubricants - Award of Appreciation  
December 1991

Work History:

First Lt., USAF (MSC), January 1956 to December 1958  
Stationed at Aeronautical Research Laboratory,  
Wright Air Development Center, Wright-Patterson Air Force Base  
as Project Engineer (Radiation Damage Research)  
Captain, USAFR (MSC), January 1959 to September 1972

Phoenix Chemical Laboratory, Inc., 3953 W. Shakespeare Ave.,  
Chicago, Illinois

Vice President: December 1950 to December 1973

Technical Director: December 1958 to date

President: January 1974 to date

Publications and Scientific Papers:

A Raman Spectral Study of Equilibria in Solutions of Strong Electrolytes. A. A. Krawetz (Doctoral Thesis University of Chicago, 1955).

Ionization of Nitric Acid in Aqueous Solution.  
T. F. Young and A. A. Krawetz (Abstracts National Meeting of American Chemical Society, Miami, Florida, April 1957).

Thermal Effects of the Interaction between Ions of Like Charge.  
T. F. Young, Y. C. Wu and A. A. Krawetz. Discussions of the Faraday Society, No. 24, (1957).

Stabilization and Purification of Nitric Acid by Ozonization.  
A. A. Krawetz and T. F. Young, Ind. and Eng. Chem. 51, 299 (1959).

Determination of Vapor Pressure by Differential Thermal Analysis,  
A. A. Krawetz and T. Tovrog, Rev. of Scientific Instruments, 33, 1465 (1962).

A Viscometer for Vulnerable Fluids, T. Tovrog and A. A. Krawetz,  
Rev. of Scientific Instruments, 36, 1261 (1965).

Differential Thermal Analysis for the Determination of the Relative Thermal Stability of Lubricants. A. A. Krawetz and T. Tovrog,  
Ind. Eng. Chem. Fundamentals, 5, 191 (1966).

Field Evaluation of Compressor Lubricant Acidity. E. Jones, A. A. Krawetz, T. Tovrog and E. E. Thompson, ASHRAE Journal 8, 54, (1966).

Improved Viscometer for Vulnerable Fluids, T. Tovrog and A.A.Krawetz,  
Rev. of Scientific Instruments, 41, 478 (1970).

The Calibration of Log Converters for Use With Spectrophotometric Systems, A. A. Krawetz, Rev. of Scientific Instruments, 41, 1986 (1970).

Demountable Gallery Infrared Cell for Soft Semi-Solids, T. Tovrog and A. A. Krawetz, Rev. of Scientific Instruments, 43, 564 (1972).

Determination of the Flammability Characteristics of Aerospace Hydraulic Fluids, C. E. Snyder, Jr., A. A. Krawetz and T. Tovrog (Program of 1980 Annual Meeting of American Society of Lubrication Engineers, Anaheim, CA).

Estimating the Solubility of Gases in Petroleum and Synthetic Lubricants, Alan Beerbower, ASLE Trans 23, No. 4, 1980. Discussion by A. A. Krawetz.

Determination of the Flammability Characteristics of Aerospace Hydraulic Fluids, Carl E. Snyder, Jr., Arthur A. Krawetz and Theodore Tovrog, Lubricating Engineering, 37, 705-714 (1981).

Dynamic Oxygen Absorption of Model Silahydrocarbon Fluids at Elevated Temperatures, L. J. Gschwender, C. E. Snyder, G. J. Chen and A. A. Krawetz, (Program of 1988 Annual Meeting of the Society of Tribologists and Lubrication Engineers, Cleveland, Ohio, May 1988).

Resistance Thermometry, A. A. Krawetz, ASTM Standardization News, 16, No. 10, 12-13, (1988).

Dynamic Oxygen Absorption of Model Silahydrocarbon Fluids at Elevated Temperatures, Lois J. Gschwender, Carl E. Snyder, Jr., Arthur A. Krawetz, Theodore Tovrog, Gregory J. Musil and Grace L. Chen, Lubrication Engineering 46, No. 2, 97-103 (1990).

#### Research Reports:

A. A. Krawetz, et al, Technical Documentary Report Index No. S-R007-08-05, The Evaluation of Pigmented Pre-Gelling Rust Preventive Coatings for Ships Ballast Tanks, U. S. Navy, Bureau of Ships Contract No. NObs-78553, January 1961.

A. A. Krawetz, et al, Technical Documentary Report ASD-TDR-63-220, Physical and Chemical Properties of Lubricants, Air Force Materials \*p 27,52\*Laboratory, Research and Technology Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, March 1963.

A. A. Krawetz, et al, Technical Documentary Report ML-TDR-64-27, Physical and Chemical Properties of Lubricants, Air Force Materials \*p 27,52\*Laboratory, Research and Technology Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, March 1964.

A. A. Krawetz, et al, Technical Documentary Report AFML-TR-65-76, Physical and Chemical Properties of Lubricants, Air Force Materials Laboratory, Research and Technology Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, March 1965.

A. A. Krawetz, et al, Technical Documentary Report AFML-TR-66-27, Physical and Chemical Properties of Lubricants, Air Force Materials Laboratory, Research and Technology Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, February 1966.

A. A. Krawetz, et al, Technical Documentary Report AFML-TR-67-133, Part I, Physical and Chemical Properties of Fluids, Lubricants and Related Materials, Air Force Materials Laboratory, Directorate of Laboratories, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, March 1967.

A. A. Krawetz, et al, Technical Documentary Report AFML-TR-67-133, Part II, Physical and Chemical Properties of Fluids, Lubricants and Related Materials, Air Force Materials Laboratory, Directorate of Laboratories, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, March 1968.

A. A. Krawetz, et al Technical Documentary Report AFML-TR-67-133, Part III, Physical and Chemical Properties of Fluids, Lubricants and Related Materials, Air Force Materials Laboratory, Research and Technology Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, June 1969.

A. A. Krawetz, et al, Technical Documentary Report AFML-TR-70-69, Part I, Chemical and Physical Properties of Lubricants, Hydraulic Fluids and Related Materials, Fluids and Lubricant Materials Branch, MANL, Non-metallic Materials Division, Air Force Materials Laboratory, Wright-Patterson Air Force Base, Ohio, April 1970.

A. A. Krawetz, et al, Technical Report AFML-TR-70-69, Part II, Chemical and Physical Properties of Lubricants, Hydraulic Fluids and Related Materials, Air Force Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, July 1971.

A. A. Krawetz, et al, Technical Report AFML-TR-70-69, Part III, Chemical and Physical Properties of Lubricants, Hydraulic Fluids and Related Materials, Air Force Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, August 1973.

A. A. Krawetz, et al, Technical Report AFML-TR-76-166, Chemical and Physical Properties of Lubricants and Hydraulic Fluids, Air Force Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, March 1976.

A. A. Krawetz and Pricha Klinsuttho, Aeronautical Analytical Rework Program, Final Report, Field Determination of the Acidity of MIL-L-23699 Lubricating Oil, Analytical Rework/Service Life Project Office, Naval Air Development Center, Warminster, PA , February 1978.

A. A. Krawetz and Pricha Klinsuttho, Aeronautical Analytical Rework Program, Final Report Prototype Kit for Field Determination of the Acidity of MIL-L-23699 Lubricating Oil, Analytical Rework/Service Life Project Office, Naval Air Development Center, Warminster, PA, May 1978.

A. A. Krawetz and Theodore Tovrog, Technical Report AFML-TR-79-4145, Chemical and Physical Properties of Lubricants and Hydraulic Fluids, Air Force Materials Laboratory, Air Force Wright Aeronautical Laboratories, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, July 1979.

A. A. Krawetz et al, Technical Report AFWAL-TR-81-4106, Thermochemical Behavior of Greases and Fluids, Air Force Materials Laboratory, Air Force Wright Aeronautical Laboratories, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, October 1981.

A. A. Krawetz, et al, Technical Report AFML-TR-85-4078 Volume I, Thermochemical Behavior of Greases and Fluids, Air Force Materials Laboratory, Air Force Wright Aeronautical Laboratories, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, June 1985.

A. A. Krawetz, et al, Technical Report AFML-TR-85-4078, Volume II, Thermochemical Behavior of Greases and Fluids, Air Force Materials Laboratory, Air Force Wright Aeronautical Laboratories, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, June 1985.

A. A. Krawetz, et al, Technical Report AFWAL-TR-88-4003, Volume I, Thermochemical Behavior of Fluids, Lubricants and Related Materials, Materials Laboratory, Air Force Wright Aeronautical Laboratories, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, March 1988.

A. A. Krawetz, et al, Technical Report AFWAL-TR-88-4003, Volume II, Thermochemical Behavior of Fluids, Lubricants and Related Materials, Materials Laboratory, Air Force Wright Aeronautical Laboratories, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, March 1988.

A. A. Krawetz, Manual for Operation of Oxygen Absorption Apparatus. Air Force Systems Command (ASD), Wright Laboratory (WL/MLBT), Wright Patterson Air Force Base, Ohio, September 30, 1991.

A. A. Krawetz, Technical Report AFWAL-TR-92-4005, Volume I, Thermochemical and Physical Behavior of Lubricants and Hydraulic Fluids, Air Force Systems Command (ASD), Wright Laboratory (ML/MLBT), Wright-Patterson Air Force Base, Ohio, March 1992.

A. A. Krawetz, Technical Report AFWAL-TR-92-4020, Volume II, Thermochemical and Physical Behavior of Lubricants and Hydraulic Fluids, Air Force Systems Command (ASD), Wright Laboratory (ML/MLBT), Wright-Patterson Air Force Base, Ohio, May 1992.

A. A. Krawetz, Technical Report WL-TR-95-4100, Thermochemical and Physical Properties of Fluids, Lubricants and Related Materials, Volume 1, Bulk Modulus and Pressure Viscosity, July 1995.

A. A. Krawetz, Technical Report WL-TR-96-4089, Thermochemical and Physical Properties of Fluids, Lubricants and Related Materials, Volume 2, Oxygen Absorption by Liquids, January , 1996.

A.A. Krawetz, Technical Report WL-TR-96-4090, Thermochemical and Physical Properties of Fluids, Lubricants and Related Materials, Volume 3, Improved Corrosion Rate Evaluation Procedure; Chemical and Physical Properties of Lubricants and Hydraulic Fluids, May, 1996.

A. A. Krawetz, Technical Report WL-TR-1996-4110, Thermochemical and Physical Properties of Fluids, Lubricants and Related Materials, Volume 4, Real-Time Friction and Wear Studies, August, 1996.

A. A. Krawetz, et al, Report of Investigation - Solvent Cleaning Project, Univ. of Dayton Research Institute, Sub-Contract RSC 00024, Prime Contract F33615-96-D-5052, January 2001.

A. A. Krawetz and Pricha Klinsuttho - B2 Hydraulic Fluid Flammability Study - B2 Hydraulic Fluid Flammability Study, Universal Technologies Corp., Delivery Order, Sub-Contract 00-5442-025-C1, Prime Contract F33615-97-D-5009, March 2002.

A.A. Krawetz, Technical Report *Thermochemical and Physical Properties of Fluids, Lubricants and Related Materials*, Volume 1, Improved Corrosion Rate Evaluation Procedure, August 2002.

A.A. Krawetz, Technical Report *Thermochemical and Physical Properties of Fluids, Lubricants and Related Materials*, Volume 2, Part 1, Chemical and Physical properties of Lubricants and Hydraulic Fluids, November 2002.

A.A. Krawetz, Technical Report *Thermochemical and Physical Properties of Fluids, Lubricants and Related Materials*, Volume 1, Part 1, Improved Corrosion Rate Evaluation Procedure: Automatic CREP System for Corrosion Rate Evaluation Procedure. July 2008.

A.A. Krawetz, Technical Report *Thermochemical and Physical Properties of Fluids, Lubricants and Related Materials*, Volume 1, Part 2, Chemical and Physical Properties of Lubricants and Hydraulic Fluids. October 2008.

Patents:

- 2,835,477 - Temperature Control Apparatus and Method
- 3,434,338 - Viscometer
- 3,510,260 - Method for Determining Acid Content of Oil Sample
- 3,559,463 - Viscometers
- 4,758,408 - Automatic Oxygen Measuring System
- 5,383,352 - Method for the Determination of Bulk Modulus  
and Pressure Viscosity as a Function of Pressure.
- 6,279,335 - Determination of Isothermal Secant and Tangent  
Bulk Modulus.

Patents Applied For:

- Method for the Rapid Determination of Corrosion Rates.
- Method for the Determination of Real-Time Wear Rates.

Registered Copyrights For Software

- TXu 783-424 - Multi Sensor Interface - Tribology Graphics
- TXu 792-768 - Multi Sensor Interface - Tribology Data  
Acquisition
- TXu 792-717 - PGRAPH (an FTIR graphics program)

Professional Societies:

- American Chemical Society
- American Institute of Chemists (Life Fellow)
- The Royal Society of Chemistry (Fellow), Chartered Chemist

American Society for Testing and Materials:

Chairman, Sub-Committee 11, Engineering Sciences (1966-2010);  
Member Sub-Committee N-6, Fire Resistance (Chairman 1974-1984); Member,  
Coordinating Sub-Committee CS91G, Task Force on Precautionary Statements  
for Hazardous Materials and Laboratory Operations (Chairman 1976-1984);  
Member, Sub-Committee 9-D, Oxidation (Chairman 1974-1981). Member,  
Committee on Standards Task Force on Precautionary Statements; Sub-  
Committee 11 representative to CS91G Task Force on Precautionary  
Statements for Hazardous Materials and Laboratory Operations.  
Member, Sub-Committees: E (Fuels), G (Grease), L (Lubricants), N (Hydraulic  
Fluids) and 9 (Oxidation). Member, Committee E-36, (Laboratory  
Accreditation) and Committee F-7, (Aerospace Materials).

Instrument Society of America

Air Pollution Control Association

Society for Applied Spectroscopy

Chicago Gas Chromatograph Discussion Group

Society of Automotive Engineers

The Society of Tribologists and Lubrication Engineers  
(formerly American Society of Lubrication Engineers)

National Lubricating Grease Institute

The Coblenz Society

National Fire Protection Association

Member - Committee on Classification and Properties of  
Hazardous Chemicals (formerly Committee on Classification  
and Properties of Flammable Liquids).  
Member - NFPA Physical and Chemical Data Consistency  
Advisory Committee.

International Association of Stability and Handling of Liquid Fuels