

MARY BLISS
Chief Scientist
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EDUCATION

Ph.D. in Solid State Science. The Pennsylvania State University
M.S. in Ceramic Science. The Pennsylvania State University
B.S. in Ceramic Science. Alfred University

THESES

Ph.D.: "Infrared Spectroscopic Investigation of Bond Character in Silicates", Advisor: Dr. William B. White.

M.S.: "An Analysis of the Reaction of PbO and Nb₂O₅ in the Presence of Molten Salts for Use in Grain-Oriented Piezoelectric 0-3 Composites", Advisors: Drs. R.E. Newnham and L.E. Cross.

Undergraduate: "The Resolutional Limit of X-Ray Powder Diffraction", Advisor: Dr. Robert L. Snyder.

PROJECT AND TECHNICAL EXPERIENCE

Materials for Radiation Detection - Since joining PNNL in 1990, Dr. Bliss's primary technical responsibility have been the leadership of DOE's only glass fiber drawing facility. The principal product is a neutron sensitive scintillating glass waveguide. Research on this material has covered basic science investigations into scintillation phenomena, glass chemistry and structure to device engineering. The waveguide is based on Li⁶ neutron capture and cerium fluorescence. The high optical performance of the waveguides enabled detectors up to 2 m in length. Dr. Bliss has formed research teams consisting of physicists, chemists, mechanical and electrical engineers to develop new processes, packages and fieldable devices for both static and mobile detectors. The largest detector produced required 250 meters of neutron sensitive fiber and was 5 m² in area. The fiber technology was licensed for commercial production to NuSAFE, LLC. Dr. Bliss was directly involved with the technology transfer and was a lead in the licensee selection and royalty negotiation. The Laboratory nominated this technology for an R&D 100 award in 1994 and won in 1999. The fiber technology has been used to monitor neutron fluxes over ten orders of magnitude. From 2000 to 2006 Dr. Bliss managed a DOE/NNSA NA-22 project on Cadmium Zinc Telluride crystal growth and electrical compensation. This project has access to proprietary commercial production processes and facilities (eV Products) as well as a major subcontract with Washington State University's Center for Materials. The project focused on Vertical Gradient Freeze crystal growth and had a budget of \$1M per year. Dr. Bliss is currently working on low background radiation detector fabrication issues. She is also a derivative classifier in a broad range of subject areas.

Chemical Sensors – Dr. Bliss initiated the fiber optic chemical sensor development program at PNNL. By teaming with chemists who specialize in selective polymer coatings, a new type of portable chemical sensor was designed and demonstrated. It demonstrated quantitative ppm sensitivity to iodine vapors. PNNL's fiber production facility allows the manufacture of fiber optics whose entire surface is an active sensor. By combining selective coating with down the fiber spectroscopy, a large surface area sensor with little or no interference was developed. The use of mass production techniques allows for large lot sizes that alleviate calibration problems for irreversible coatings.

Specialty Fiber Optics and Devices – Dr. Bliss initiated a three-year program to investigate specialty fiber optics for secure loop seals. These fibers were highly splice resistant. Dr. Bliss has also been involved with work on fiber optic sensors for physical properties. This includes work that resulted in a patent application for a readout system for fiber optic sensors and wavelength-based sensors.

Materials Characterization – Dr. Bliss has an excellent background in vibrational spectroscopy and inorganic materials structure analysis. She has experience in tensor analysis of all major physical properties, phase equilibria and microstructure development. She is experienced in x-ray characterization methods including single crystal analysis, electron microscopy, semiconductor characterization, optical, infrared and Raman spectroscopy.

Prior to PNNL Dr. Bliss worked at General Electric Neutron Devices, a DOE facility in Largo, FL. There she worked in the production support laboratory, performing quality assurance analysis on raw materials and assisting in contamination control, production problems and failure analysis of complex parts. This facility manufactured a wide variety of parts made from metals, plastics and ceramics. It operated as a secure QA Level 1 facility.

Dr. Bliss was a summer intern in the Material Control and Applied Research group, at Corning Glass Works (now Corning Inc). The group was responsible for chemistry control and raw material quality of all glasses in commercial production. She spent two summers at Corning's main plant facility in Corning, NY. She supported Pyrex production, triangular red-reading thermometer tubing, Stuben crystal, optical tints and a variety of other specialty glasses then in production. Her tasks varied from adjusting raw material batch chemistry to accommodate trace chemical variations in raw materials, to developing new glass chemistries based on raw material availability, and production support. While at Corning she monitored the construction and start-up of a new Pyrex tank designed to produce 250,000 lbs. of glass per day, worked on a color problem in the Stuben tank (200 lbs. per day) caused by a stainless steel nut entering the batch. She reformulated an ophthalmic glass and designed a green glass substitute for apprentices to use during the Stuben shut down. She also witnesses a tank failure resulting in the loss of 100,000 lbs. of glass.

PATENTS

U.S. Patent # 5,704,890 "Real Time Sensor for Therapeutic Radiation Delivery"

U.S. Patent # 6,151,769 "Method of Making a Scintillator Waveguide"

U. S. Patent # 6,551,231 "Scintillator Waveguide for Sensing Radiation"

U. S. Patent # 6,580,079 "Method to Measure Hydrogen-bearing Constituent in a Material Using Neutron Spectroscopy"

U. S. Patent # 6,628,072 "Acicular Photomultiplier Photocathode Structure"

U. S. Patent # 6,707,047 "Method to Measure Hydrogen-Bearing Constituent in a Material Using Neutron Spectroscopy"

AWARDS AND HONORS

12/19 – PNNL National Security Directorate Derivative Classifier of the Year

2017, 2018, 2019 – Nominated for PNNL National Security Directorate Derivative Classifier of the Year

6/05 – The American Chemical Society 60 th Northwest Regional Industrial Innovation Award (shared with N. A. Wogman) for the development of PUMA a revolutionary radiation monitoring system that uses glass fibers to detect the presence of radionuclides such as plutonium.

3/00 – Battelle's Pacific Northwest Division Woman of Achievement. Dr. Bliss is one of two winners named by the laboratory in honor of Woman's History Month.

9/99 – R&D 100 Award for one of the Best New Technologies of the year for "PUMA Fiber Optic Neutron and Gamma Ray Sensor. Dr. Bliss was one of six PNNL staff on the team along with two employees of Oxford Instruments, Nuclear Measurements Group.

1/99 – Federal Laboratory Consortium Technology Transfer Award for the commercialization of the neutron sensitive scintillating glass fibers. This is one of 15 awards given in 1999. The competition is among 540 U. S. Government Laboratories.

8/96 - Nominated by PNNL for the American Institute of Physics Maria Goeppert-Mayer Award.

9/83 - 5/84 Corning Glass Works graduate Fellowship

5/81 - Magna Cum Laude graduate Alfred University

5/79 - Sigma Xi Award for Undergraduate Research - "Coloring Agents in Chrysoptase, Blue and Green Aventurine"

1977 - American Chemical Society Outstanding First Year Chemistry Award, Pace University.

Dr. Bliss has over 80 publications in her field and numerous proceeding articles and government reports. Her publications are available in Research Gate, Mendeley and Orchid. (<https://orcid.org/0000-0002-7565-4813>)

Dr. Bliss is a member of Keramos, Phi Kappa Phi and Sigma Xi honor societies. She is a member of the American Ceramic Society and has been active in the SPIE.