

Exponent®
Engineering & Scientific Consulting


## Josh Swann, Ph.D., P.E., CFEI

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## Professional Profile

Dr. Swann is a licensed fire protection engineer and leverages his knowledge of fire protection engineering, fire dynamics, and heat transfer principles to analyze building fire protection and life safety systems, evaluate the fire performance of various materials and products, and conduct origin and cause determinations for residential, commercial, industrial, and vehicle fire and explosion events. Dr. Swann's diverse training and practical experience includes the design and testing of active and passive fire protection systems and building life safety systems, conducting building and fire code assessments, and performing engineering hazard and risk analyses.

Dr. Swann specializes in the investigation and root cause failure analysis of all types of active and passive fire protection systems in residential, commercial, manufacturing, industrial, and storage occupancies. He has practical experience evaluating failures involving automatic fire sprinkler systems (failure to operate during a fire event or inadvertent discharge due to freezing, corrosion, mechanical damage, and excess heat), standpipes and sprinkler water delivery systems, commercial kitchen suppression and ventilation systems, industrial and vehicle wet and dry chemical suppression systems, fire extinguishers, fire detection systems and smoke alarms, mechanical and HVAC systems, consumer products and electronics, and occupant egress systems. Dr. Swann also has experience investigating explosions and fires involving liquified petroleum (LP) and natural gas distribution piping, regulators, and cylinders as well as liquid fuel tanker trucks.

Dr. Swann provides expertise in building and fire code consultation for the installation, maintenance, and operation of active and passive fire protection and life safety systems for residential, commercial, and industrial occupancies. He has identified applicable codes and standards and subsequently evaluated the performance of automatic fire sprinkler systems, pre-engineered suppression systems, occupant egress systems, and automatic fire alarm and detection systems. His experience includes analyzing the fire performance of materials for various applications and the evaluation and inspection of buildings, facilities, and products for code compliance in accordance with codes published by the National Fire Protection Association (NFPA), the International Code Council (ICC), as well as requirements of state and local jurisdictions.

Dr. Swann has practical experience developing and performing fire experiments to evaluate the dynamics of pyrolysis, ignition properties, and fire performance of a plethora of materials under a wide range of failure conditions. He is familiar with small- and large-scale standardized fire tests conducted in accordance with standard tests methods such as those published by ASTM International (formerly American Society for Testing and Materials), American National Standards Institute (ANSI), NFPA, International Organization for Standardization (ISO), Underwriters Laboratories (UL), and the Code of Federal Regulations (CFR). Dr. Swann has experience conducting and analyzing oxygen consumption cone calorimetry (ASTM E1354), flash point and fire point (ASTM D92 and D93), textile flammability (16 CFR 1610 and 1615/1616), and plastic flammability (UL 94) tests. Dr. Swann has designed, constructed,

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and carried out customized fire test procedures to evaluate a plethora of complex scenarios. He also has practical experience utilizing milligram-scale thermal analysis techniques such as thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) as well as bench-scale tests such as oxygen consumption cone calorimetry. Dr. Swann has experience conducting fire tests on a wide range of materials and products including polymeric materials, fabrics and textiles employed in apparel and personal protective equipment (PPE), insulation and building materials, liquid chemicals, household appliances, HVAC equipment, microwaveable food products, and lithium-ion batteries. He also has practical experience evaluating smoke alarms and high-pressure gas cartridges in various fire exposure scenarios.

Prior to joining Exponent, Dr. Swann conducted material flammability research at the University of Maryland in the Department of Fire Protection Engineering. Dr. Swann's graduate research included the development, construction, and operation of the Controlled Atmosphere Pyrolysis Apparatus II (CAPA II) to perform gasification experiments on highly charring and intumescent polymeric materials employed in applications ranging from medical devices to construction materials. He subsequently derived and validated comprehensive pyrolysis models based on milligram-scale (TGA, DSC, and Microscale Combustion Calorimetry (MCC)) and gram-scale (CAPA II) thermal analysis and pyrolysis experimental data. This work was funded by the U.S. National Science Foundation.

## Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, University of Maryland, College Park, 2019

M.S., Mechanical Engineering, University of Maryland, College Park, 2018

B.S., Fire Protection Engineering, University of Maryland, College Park, 2014

Committee Memberships

Principal Member: Technical Committee on Fire Doors and Windows (FDW-AAA), NFPA 80: Standard for Fire Doors and Other Opening Protectives and NFPA 105: Standard for Smoke Door Assemblies and Other Opening Protectives, National Fire Protection Association, 2021-present.

Principal Member: Technical Committee on Board and Care Facilities (BLD-BCF), NFPA 101: Life Safety Code and NFPA 5000: Building Construction and Safety Code, National Fire Protection Association, 2021-present.

Awards

2020 Triennial Best Thesis Award – Excellence in Research. The International Association for Fire Safety Science (IAFSS) and the Forum of Fire Research Directors (FORUM) recognizes the best research thesis at Ph.D. and Masters' levels, in all the fields related to fire safety science and engineering.

2017 Triennial Sheldon Tieszen Student Award. The International Association for Fire Safety Science (IAFSS) and the Forum of Fire Research Directors (FORUM) recognizes excellence in an IAFSS symposium paper in fire safety science by a student.

## Licenses and Certifications

Professional Engineer Fire , California, #2135

Professional Engineer Fire , Delaware, #28078

Professional Engineer, Maryland, #45668

Professional Engineer, New Jersey, #24GE05931400

Professional Engineer, Pennsylvania, #PE093803

Professional Engineer, Virginia, #0402065824

Professional Engineer, Washington DC, #PE40001043

Certified Fire and Explosion Investigator (CFEI)

Fire Investigation Technician (IAAI - FIT) in accordance with the International Association of Arson Investigators

## Professional Affiliations

International Association of Arson Investigators – IAAI (member)

National Association of Fire Investigators – NAFI (member)

National Fire Protection Association – NFPA (member)

National Fire Sprinkler Association – NFSA (member)

Society of Fire Protection Engineers – SFPE (member)

## Publications

Swann JD and Nava NA. Impact of Loss of Heat on Fire Sprinkler System: How to Reduce the Likelihood of Sprinkler Piping Freeze Failures. NFSA National Fire Sprinkler Magazine, No. 229, November/December 2021.

Swann JD and Stoliarov SI. Determination of Pyrolysis and Combustion Properties of Poly(vinylidene fluoride) using Comprehensive Modeling: Relating Heat Transfer to the Intumescent Char's Porous Structure. Fire Safety Journal; 120:103086;2021.

Misera A and Swann JD. New Guidance on Fire Sprinkler Life Cycles Based on the 2020 Edition of NFPA 25. NFSA National Fire Sprinkler Magazine, 2020.

Swann JD, Ding Y, Stoliarov SI. Comparative Analysis of Pyrolysis and Combustion of Bisphenol A Polycarbonate and Poly(ether ether ketone) using Two-Dimensional Modeling: A Relation between Thermal Transport and the Physical Structure of the Intumescent Char. Combustion and Flame; 212:469-485; 2020.

Swann JD, Ding Y, Stoliarov SI. A Quantitative Comparison of the Pyrolysis and Combustion Behavior of Plasticized and Rigid Poly(vinyl chloride) using Two-Dimensional Modeling. Fire Safety Journal; 111:102910; 2020.

Ding Y, Swann JD, Sun Q, Stoliarov, SI. Development of a Pyrolysis Model for Glass Fiber Reinforced Polyamide 66 Blended with Red Phosphorous: Relationship between Flammability Behavior and Material Composition. Composites Part B: Engineering; 176:107263; 2019.

Swann JD, Ding Y, Stoliarov SI. Comparison of Pyrolysis and Combustion Properties of Rigid and Plasticized Poly(vinyl chloride). Proceedings, 9th International Seminar on Fire and Explosion Hazards, Saint Petersburg, Russia, 2019.

Swann JD, Ding Y, Stoliarov SI. Characterization of Pyrolysis and Combustion of Rigid Poly(vinyl chloride) Using Two-Dimensional Modeling. International Journal of Heat and Mass Transfer; 132:347-361; 2019.

Swann JD, Ding Y, McKinnon MB, Stoliarov SI. Controlled Atmosphere Pyrolysis Apparatus II (CAPA II): A New Tool for Analysis of Pyrolysis of Charring and Intumescent Polymers. Fire Safety Journal; 91:130-139; 2017.

**Presentations**

Swann JD and Stoliarov SI. Determination of Pyrolysis and Combustion Properties of Poly(vinylidene fluoride) using Comprehensive Modeling: Relating Heat Transfer to the Intumescent Char's Porous Structure. Oral presentation, 13th International Symposium on Fire Safety Science, Virtual Conference, 2021.

Swann JD, Ding Y, Stoliarov SI. Characterization of Pyrolysis and Combustion of Polycarbonate using Two-Dimensional Modeling. Oral presentation, European Meeting on Fire Retardant Polymeric Materials, Turku, Finland, 2019.

Swann JD, Ding Y, Stoliarov SI. Comparison of Pyrolysis and Combustion Properties of Rigid and Plasticized Poly(vinyl chloride). Oral presentation, 9th International Seminar on Fire and Explosion Hazards, Saint Petersburg, Russia, 2019.

Swann JD, Ding Y, Stoliarov SI. Characterization of Pyrolysis and Combustion of Rigid Poly(vinyl chloride) Using Two-Dimensional Modeling. Poster presentation, 9th International Seminar on Fire and Explosion Hazards, Saint Petersburg, Russia, 2019.

Swann JD, Ding Y, McKinnon MB, Stoliarov SI. Controlled Atmosphere Pyrolysis Apparatus II (CAPA II). Oral Presentation, 12th International Symposium on Fire Safety Science, Lund, Sweden, 2017.

Swann JD, Ding Y, McKinnon MB, Stoliarov SI. Experimental Study of Anaerobic Pyrolysis of Poly(vinyl chloride). Oral Presentation, 10th U.S. National Combustion Meeting, College Park, MD, 2017.

Swann JD, Ding Y, McKinnon MB, Stoliarov SI. Controlled Atmosphere Pyrolysis Apparatus II (CAPA II). Oral Presentation, 8th Triennial International Aircraft Fire and Cabin Safety Research Conference, Atlantic City, NJ, 2017.

Swann JD, Ding Y, McKinnon MB, Stoliarov SI. Controlled Atmosphere Pyrolysis Apparatus II (CAPA II): A New Tool for Analysis of Pyrolysis of Charring Polymers. Poster presentation, American Chemical Society: Fire and Polymers Symposium, Philadelphia, PA, 2016.

Swann JD, Scheffey JL. Aircraft Loading Walkways - Literature and Information Review. Oral presentation, National Fire Protection Association's (NFPA) Conference & Exposition, Las Vegas, NV, 2014.

**Reports**

Swann JD, Scheffey JL. Aircraft Loading Walkways - Literature and Information Review. National Fire Protection Association, Fire Protection Research Foundation, May 2014.

## Additional Education & Training

"SFFD requirements for Fire Service Access Elevators per 2021 IBC, 2022 NFPA 72 and 2022 SFFD AB #5.08" webinar, The Society of Fire Protection Engineers (SFPE), 1.5 PDH, January 26, 2023

Electrical Aspects of Fire Investigation, International Association of Fire Investigators (IAAI), 24 hour tested course, Nov 1-3, 2022.

“The Use of Research and Forensics in Developing Industry Best Fire Protection Practices for Lithium Ion Applications” webinar, The Society of Fire Protection Engineers (SFPE), 1 PDH, December 9, 2022

Kitchen Suppression Systems Hands-On Training, FED Learning Center, 13 hour course, January 18-19, 2022

“Protecting the Future of Lithium-Ion Batteries” webinar, The Society of Fire Protection Engineers (SFPE), 1 PDH, September 27, 2021

Fire Pumps/Controllers & Air Supply Equipment with SPP & General Air, 2 NICET Credits, September 15, 2020.

Planning Ahead – Fire Sprinkler System Accessories for Freeze Protection & Corrosion Monitoring, 1 NICET Credit, July 23, 2020.

Fundamentals of Water-Based Fire Protection Systems Classroom and Hands-On Training, Viking Group, Inc., 13.5 hour course, January 8-9, 2020.

Inspection, Testing, and Maintenance (ITM) of Water-Based Fire Protection System Classroom and Hands-On Training, National Fire Protection Associated (NFPA), 21 hour course, October 8-10, 2019.

Advanced Fire, Arson & Explosion Investigation Training Program, National Association of Fire Investigators (NAFI), 28 hour course, July 15-18, 2019.

Asbestos Awareness Training, in accordance with OSHA 29 CFR 1910.1001, 29 CFR 1915.1001, and 29 CFR 1926.1101, June 11, 2019.

**International Associated of Arson Investigators (IAAI)/CFITrainer.net:**

NFPA 1033 & 921: 2022/2021 Editions Important Updates, July 14, 2022, 3 hour tested training

The Practical Application of the Relationship Between NFPA 1033 and NFPA 921, October 19, 2021, 2 hour tested training

Photovoltaic Cells & Systems, September 17, 2021, 4 hour tested training

Lithium-Ion Battery Fires, August 17, 2021, 1 hour tested training

Introduction to Appliances, August 13, 2020, 3 hour tested training

Introduction to Fire Dynamics and Modeling, August 7, 2020, 4 hour tested training

Thermometry, Heat, and Heat Transfer, July 24, 2020, 3 hour tested training

Understanding Fire Through the Candle Experiments, July 24, 2020, 4 hour tested training

The Impact of Ventilation in Building Structures on Fire Development, July 24, 2020, 4 hour tested training

Electrical Safety, July 13, 2020, 3 hour tested training

Arc Mapping Basics, July 13, 2020, 4 hour tested training

Introduction to Evidence, May 22, 2020, 4 hour tested training

Fire Protection Systems, May 20, 2020, 3 hour tested training

Fire Investigation for Fire Officers, April 8, 2020, 3 hour tested training

How First Responders Impact the Fire Investigation, April 7, 2020, 2 hour tested training

Insurance and the Fire Investigation, April 7, 2020, 4 hour tested training

Writing the Initial Origin and Cause Report, April 4, 2020, 3 hour tested training

Effective Investigation and Testimony, April 2, 2020, 3 hour tested training

Fundamentals of Interviewing, April 1, 2020, 4 hour tested training

Explosion Dynamics, March 30, 2020, 4 hour tested training

Residential Natural Gas Systems, March 28, 2020, 3 hour tested training

Investigating Motor Vehicle Fires, March 23, 2020, 4 hour tested training

Physical Evidence at the Fire Scene, March 23, 2020, 4 hour tested training

Documenting the Event, January 24, 2020, 4 hour tested training

Understanding Undetermined, January 24, 2020, 3 hour tested training

Critical Evaluation and Testing of Commonly Reported Accidental Causes, January 23, 2020, 3 hour tested training

Fire Flow Analysis, January 23, 2020, 3 hour tested training

Fire Investigator Scene Safety, January 23, 2020, 3 hour tested training

Residential Electrical Systems, January 23, 2020, 4 hour tested training

Ethics and the Fire Investigator, January 20, 2020, 3 hour tested training

NFPA 1033 and Your Career, January 20, 2020, 2 hour tested training

The Scientific Method for Fire and Explosion Investigation, November 20, 2019, 3 hour tested training

Fire Chemistry, November 18, 2019, 3 hour tested training

Fundamentals of Residential Building Construction, November 14, 2019, 3 hour tested training

Basic Electricity, November 13, 2019, 4 hour tested training

Investigating Natural Gas Systems, November 13, 2019, 3 hour tested training

An Analysis of The Station Night Club, October 17, 2019, 4 hour tested training

Charting Your Career Path in Fire Investigation, March 19, 2019, 3 hour tested training

## Peer Reviews

Award Reviewer, Triennial Best Thesis Award – Excellence in Research, International Association of Fire Safety Sciences, 2023.

Technical Reviewer, 13th International Symposium on Fire Safety Science (IAFSS) and special edition of the Fire Safety Journal, 2020.

Technical Reviewer, 1st International Symposium on Lithium Battery Fire Safety, 2019.