

# MAE Seminar SERIES

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## 125 YEARS OF SYNTHETIC GRAPHITE

(THE GRAFFIN LECTURE SPONSORED BY THE AMERICAN CARBON SOCIETY)

### ABSTRACT

Graphite is an allotrope of carbon. In addition, the term 'graphite' is used to refer to a class of indispensable engineered carbon materials that have been at the forefront of energy technology, and especially electrification, for at least a century. One milestone was reached in 1896 with E.G. Acheson's "Manufacture of Graphite" patent that enabled scale production and commercial applications of synthetically produced graphite. Previously only natural graphite or less ordered carbon was available. Today, the graphite materials segment represents a \$15-20 billion global industry, with over 3 million tons produced every year in various forms, growing at a rate of over 5% per year. These include carbon fiber for composites, blocks for nuclear reactors, anode powders for lithium-ion batteries, flexible sheets for portable electronics, hot zone components for semiconductor crystal growing furnaces, and graphite electrodes for arc furnaces. These graphite materials are enabling advancements in nearly every aspect of modern energy technology, such as aerospace and automotive light-weighting, next generation nuclear reactor designs, higher performance and lower cost electric vehicles, faster charging electronics, growth in semiconductor market, and more-efficient steel recycling. The goal of this talk is to highlight the fundamentals of graphite materials technology, including the raw materials, processing, structure, and properties that enable graphite materials to play a critical role in today's products and applications. It will be shown that in addition the rich history and growth, the future continues to hold more opportunities, in ever increasing areas. The story of carbon and graphite materials is indeed the story of modern technology and society.

### BIO SKETCH

Ryan M. Paul is a carbon materials scientist in the Carbon and Composites Group in the Chemical Sciences Division at Oak Ridge National Laboratory. He has a B.E. and M.S. from Youngstown State University, and a M.S. and Ph.D. from The Ohio State University. His Ph.D. dissertation was on the topic of modeling pore structure evolution during graphite oxidation. Prior to joining ORNL, Ryan spent over nine years in industry, as Associate Director of R&D and materials scientist at GrafTech International Holdings Inc., in Cleveland, OH. At GrafTech, he worked on a number of applied projects across several lines of business and helped to commercialize several new products and processes. Since joining ORNL, he has been actively involved in nuclear graphite research, including participating in ASTM D02.F0 meetings and the ASME Nonmetallics Design and Materials Working Group. He also leads research on pitch based carbon fibers.



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