IOWA STATE UNIVERSITY
Center for Nondestructive Evaluation

# CNDE Webinar Presentation
# July 17, 2025 - 10:00 a.m. CST

**This webinar will be recorded and made available on the CNDE website**

## Challenges and Opportunities in Gradient Materials: From Metallurgy to Processing to Inspection

**Presented by:**

**Dr. Pete Collins**
**Professor, Materials Science and Engineering**
**Iowa State University**

**Abstract:**

It is possible to manufacture metallic materials in such a way that their materials state is spatially varied in a controlled and intentional way. Such gradients may be considered "functionally graded materials", as the properties, whether mechanical, magnetic, thermal, or electrical, vary by location and can be designed to either increase the capabilities of a single part and/or decrease the number of parts in use. While potentially transformative, there are challenges that remain ranging from metallurgical challenges (how does one predict properties?) to processing (how do processing parameters change dynamically to achieve desired materials state) to, ultimately, a question of inspectability. How can one inspect a part whose composition and/or thermal history result in strikingly different and spatially varying materials states, each with a different set of physical properties that govern inspection techniques. This talk will present the state-of-the-art in the design, manufacture, and measurement of gradient materials, and will introduce new emerging concepts related to NDE techniques that relate to new theoretical possibilities for the inspection of gradient materials.

**Speaker:**

Pete Collins has studied metallurgy and materials science, earning his PhD in Materials Science from The Ohio State University. After setting up a not-for-profit manufacturing facility within a Department of Defense installation in 2009/2010, he rejoined the research community and began his academic career in 2010 at the University of North Texas before moving to Iowa State University in 2015. His research interests have involved metallurgy and advanced characterization and advanced processing techniques. He tends to work on industrially-relevant or industrially-scaled problems, while applying fundamental theories to support advancements in the state-of-the-art. He is the Stanley Chaired professor in Interdisciplinary Engineering at Iowa State University, and has served as Center Director of 3 Centers (including CNDE), and is on the technical board of the Quad Cities Manufacturing Institute. He has recently joined as a co-author of a seminal book in Materials Processing ("DeGarmo's Materials and Processes in Manufacturing"), and has more than 80 peer reviewed publications and 3 patents. In recent years, he has invested his time in research involving materials gradients, and new methods of inspection for large-scale specimens.

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