



MATERIALS SCIENCE & ENGINEERING DISTINGUISHED SEMINAR SERIES



Frank Ernst

Dr. rer. nat. habil.

Leonard Case Jr. Professor of
Engineering

Department Chair

Department of Materials Science
and Engineering
Case Western Reserve University

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Zoom

[Meeting Room](#)

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A New Perspective on Alloy Surface Engineering by Infusing High Concentrations of Interstitial Atoms

Alloy surface engineering by infusing high concentrations of interstitial atoms is an established technology, e.g. implemented as low-temperature carburization of austenitic stainless steel. This technology enables outstanding improvements in surface hardness, wear-, fatigue-, and corrosion resistance by generating a subsurface zone in which the fraction of interstitial atoms can approach 0.15, exceeding equilibrium typical solubility limits by several orders of magnitude. Hitherto, this condition and the resulting properties have been understood in terms of a solid solution of interstitial atoms (carbon). However, various properties and their dependence on the level of interstitial atoms do not agree with predictions of solid solution theory. Rather, recent experimental observations related to processing and properties suggest the formation of a disordered compound with a variable fraction of the infused atoms. This model enables a deeper physical understanding, increasing the potential for intelligent alloy surface engineering.

Biography: Frank Ernst joined the Department of Materials Science and Engineering at Case Western Reserve University (CWRU) in 2000. He is leading a research group focused on microstructure and micro-characterization of materials. Current research interests include surface-engineering of structural alloys, metal plating, materials for energy conversion, heteroepitaxial interfaces, and advanced methods of microcharacterization. He is the Director of the Case Center for Surface Engineering (CCSE) and the Faculty Director of the Swagelok Center for Surface Analysis of Materials (SCSAM). In 2016, he was appointed Chair of the Department of Materials Science and Engineering.

Educated as a physicist at the University of Göttingen, Germany, he received his diploma (MSc) in 1984 and was promoted to Doctor rerum naturalium (PhD) in physical metallurgy in 1987. Under the guidance of his advisor, Peter Haasen, he became deeply interested in materials microstructures and advanced techniques of TEM (transmission electron microscopy). After a period as postdoctoral research associate at CWRU in 1987/88, where he studied the structure of metal-oxide- and semiconductor heterointerfaces with one of the first atomic-resolution electron microscopes, he was appointed as senior scientist at the Max-Planck-Institut für Metallforschung (Stuttgart) in 1989. In the Department of “Electron Microscopy and Internal Interfaces,” he headed a group working on atomic-resolution TEM of grain boundaries and heterointerfaces and developed the method of “quantitative HRTEM.” In 1997, he completed his habilitation with a professorial thesis on the “Structure of Heterointerfaces” and received the *venia legendi* from the University of Stuttgart. In 2000, he returned to CWRU as Professor.