

Title:**From Order to Entropy: Perspectives on XRD Phase Analysis in High-Entropy Oxides****Abstract**

High-entropy oxides represent a rapidly growing class of ceramic materials in which structural complexity, chemical disorder, and configurational entropy challenge traditional concepts of phase formation and structural interpretation. While their X-ray diffraction (XRD) patterns often appear deceptively familiar, assigning structural meaning in such systems increasingly relies on experience-driven and context-aware interpretation rather than straightforward pattern matching.

This plenary lecture presents perspectives on the XRD characterization of compositionally complex oxides, including classical and compositionally complex fluorite systems, high-entropy pyrochlores, and spinels. Through selected case studies, it highlights recurring interpretative questions related to average structure, phase stability, and the role of disorder across different crystallographic families.

Particular emphasis is placed on the role of crystallographic databases when used as active analytical tools rather than passive references, supporting the identification of structural trends and compositional variability in highly complex oxide systems. High-entropy oxides are thus presented not only as advanced functional materials, but also as an opportunity to reflect on how XRD-based phase analysis is interpreted as materials complexity continues to increase.