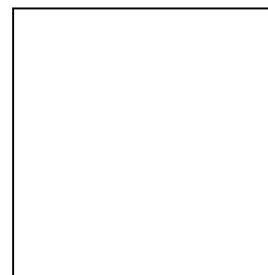


CHEMICAL SHORT-RANGE ORDER AND LOCAL LATTICE DISTORTIONS IN HIGH-ENTROPY ALLOYS: STATE OF THE ART

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Understanding the complex atomic-scale structures within High-Entropy Alloys (HEAs) is crucial for tailoring their properties to diverse applications. The present contribution aims to provide an overview of the state-of-the-art experimental techniques employed in probing local lattice distortions and chemical short-range order in HEAs: from synchrotron/neutron-based techniques such as X-ray absorption spectroscopy and X-ray / neutron total scattering to less known techniques such as single-crystal diffuse scattering and atomic-resolution holography. The primary challenges in analyzing multi-component alloys lie in the inherent reduced scattering contrast between the five or more alloying elements, often neighbors in the periodic table, and their simple crystal structures with few or even one single Wyckoff site. These characteristics constrain the amount of information that can be obtained from the data, statement that applies to transmission electron microscopy, as well.

At the laboratory level, the more accessible thermo-physical methods such as differential scanning calorimetry and electrical resistivity showed to be valuable in the corroboration and quantitative estimation of ordering within HEAs.

It becomes evident that rather than relying solely on individual techniques, it is the combination of several experimental approaches, ideally complemented by simulations, that can effectively assign the contribution of each element to the alloy structure and, ideally, to the overall alloy performance. It is, therefore, important to recognize that each experimental method has its own strengths and weaknesses, which will also be shortly addressed.

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