Séminaire de Mathilde LAURENT-BROCQ

Institut de Chimie des Matériaux de Paris Est, UMR CNRS 7182, Thiais, France

mathilde.laurent-brocq@cnrs.fr

Lundi 14 novembre 2022 à 14h00
Salle Patrick Alnot, IJL

How high entropy alloys invite us to re-discover metallurgy

Since the discovery of the single-phased CoCrFeMnNi alloy and the proposition of the concept of high entropy alloys (HEA) in 2004, the understanding of the behavior and properties of those materials has tremendously improved. We can now say that, against all expectations, HEA are just like other alloys. Well, almost. In other words, those alloys follow the classical laws of thermodynamics, diffusion, mechanics ... in short the laws of physics and chemistry, but not always the approximations that are commonly done for conventional alloys. We will illustrate it, especially for configurational entropy and X-ray absorption.

Thus, it appears that the interest of HEA does not lie in their specificity but rather in the opportunity and the challenge that they raise to explore wide domains of composition. First, a challenge. We will show it through a complete thermodynamic description of the Co-Cr-Fe-Mn-Ni, which requires massive data calculations, new plotting methods and experimental validation. The study of solid solution strengthening relies on a similar approach, which will also be presented. Second, opportunities. Indeed, promising HEA compositions were identified for two fields of applications (airplane turbine blades and tubes for petrochemistry industries). We will present the strategy of selection and the experimental validations.

Finally, high entropy alloys have inspired a new strengthening mechanism, by chemical architecturation. We will expose the processing, the microstructural characterization and the mechanical properties of chemically architectured high entropy alloys.