

## How Can We Tune the Short-range Order (SRO) in Multi-principal Element Alloys (MPEA)s?

Short-range order (SRO) in multi-principal element alloys (MPEAs) has an impact on the material properties, but controlling SRO remains a complex challenge. It is generally assumed that quenched samples closely resemble a random solid solution (RSS), while annealed samples exhibit higher degrees of SRO. This raises a key question: to what extent do quenched MPEAs deviate from an RSS state? In this study, we combine advanced transmission electron microscopy (TEM) techniques, additive manufacturing, and atomistic modeling to investigate SRO in three CoCrNi-based face-centered cubic (FCC) MPEAs. Surprisingly, we find that SRO develops rapidly during solidification, even at high cooling rates. Therefore, quenched samples retain significant SRO level and differ notably from an RSS state.