IN-SITU TEM STRAINING EXPERIMENTS IN CANTOR'S ALLOY AT ROOM AND LN_2 TEMPERATURES

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Cantor's single-phase equiatomic FeNiCoCrMn alloy is a "high-entropy" alloy (or HEA) which crystallizes in the face-centered cubic (fcc) crystal structure. Its mechanical properties include high strength, particularly at low temperatures, good ductility and a large number of slip systems [1], on which its plasticity largely depends.
To have a better understanding of these properties, *in situ* TEM straining experiments were carried out at room and liquid nitrogen temperatures, with a straining holder that applies mechanical stress on the specimen (locally measured using dislocations' curvature) to analyze dislocation movements. According to previous studies, the planar slip of dislocations is responsible for the first stages of plasticity and twinning starts afterwards [1] [2] [3]. The strengthening mechanisms are a result of the classical dislocation/obstacle (grain boundary, twinning) interaction, but also of the local lattice distortions that may impede moving dislocations. These interactions seem to affect both perfect and partial dislocations.

Preliminary results of these *in situ* TEM straining experiments allow us to better understand the local deformation mechanisms in single-phase fcc equiatomic FeNiCoCrMn HEA: perfect dislocation slip and twinning initiations. Further testing is needed to gather more statistical data, however *in situ* TEM straining proves to be a powerful approach to observe the ongoing process of plastic deformation.

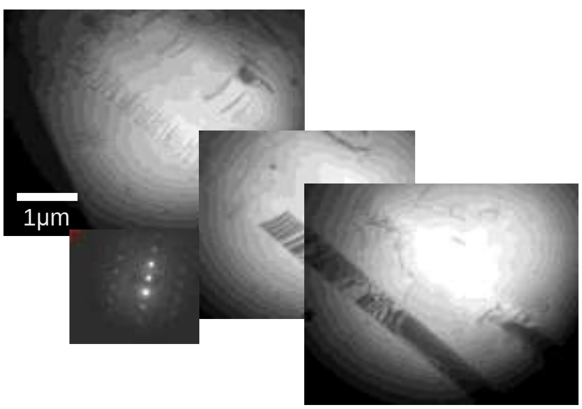

Figure 1 – In-situ straining at TLN_2 showing both planar slip and twinning

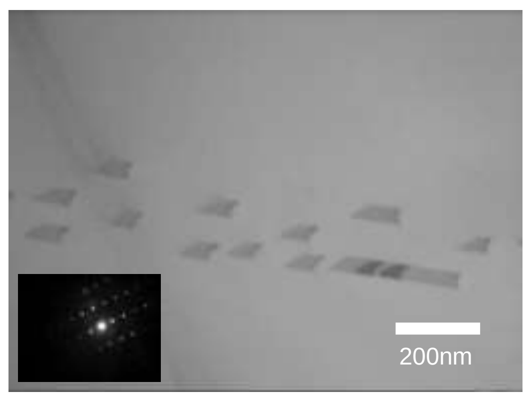

Figure 2 – Dislocations dissociated due to local lattice distortions

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References:
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