Quinary Interstitial TRIP Compositionally Complex Alloys

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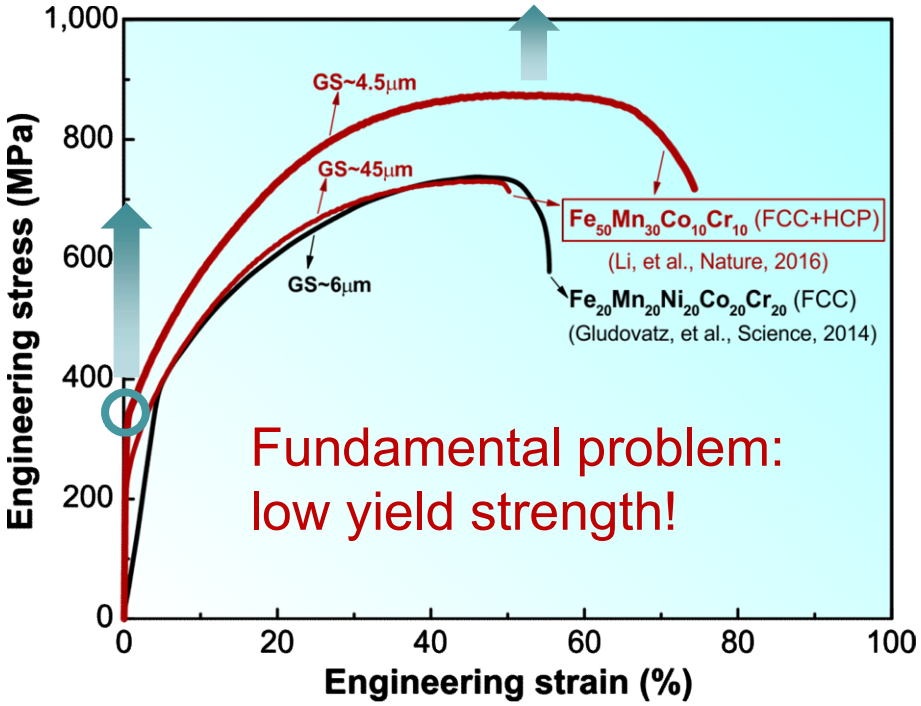
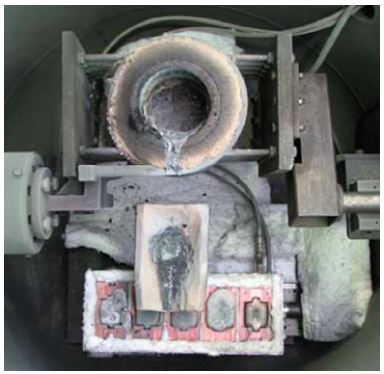
Priority Programme 2006
“Compositionally Complex Alloys – High Entropy Alloys (CCA-HEA)”

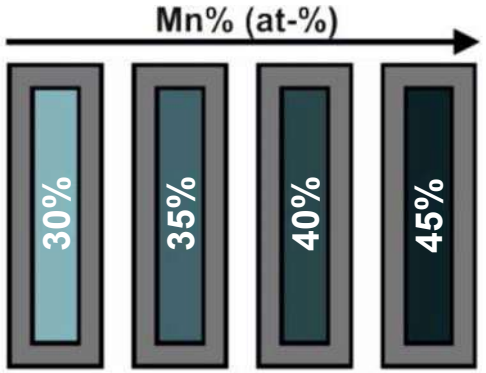
Quinary TRIP-iCCAs: state-of-the-art – motivation



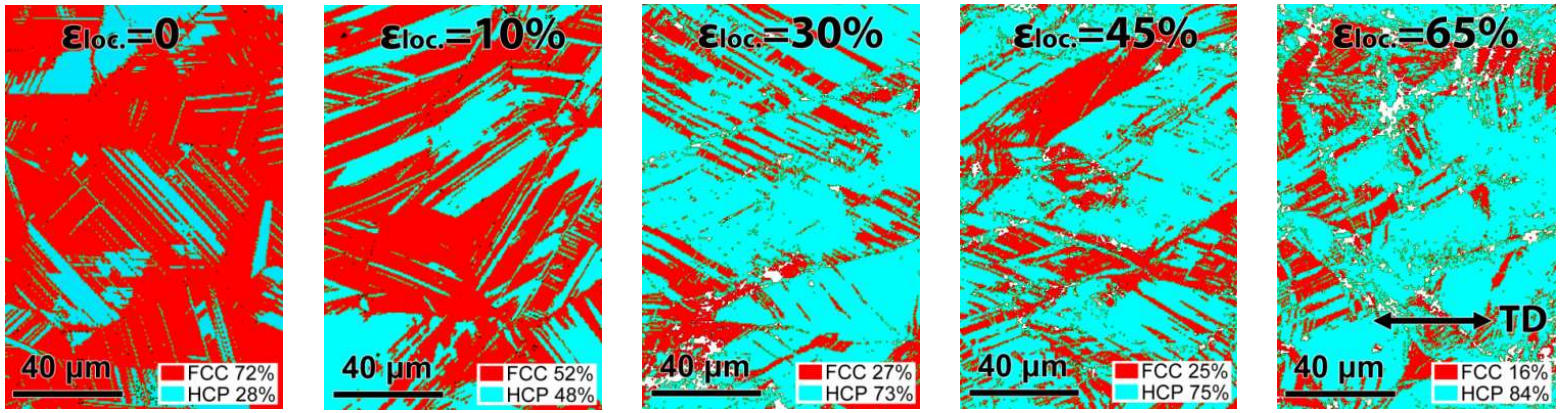
Single-phase $Fe_{20}Mn_{20}Ni_{20}Co_{20}Cr_{20}$
relatively low strength

$Fe_{80-x}Mn_xCo_{10}Cr_{10}$ (x=45, 40, 35, 30)





Rapid Alloy Prototyping



Local strain

Z. Li, et al., Nature 534, 227 (2016).

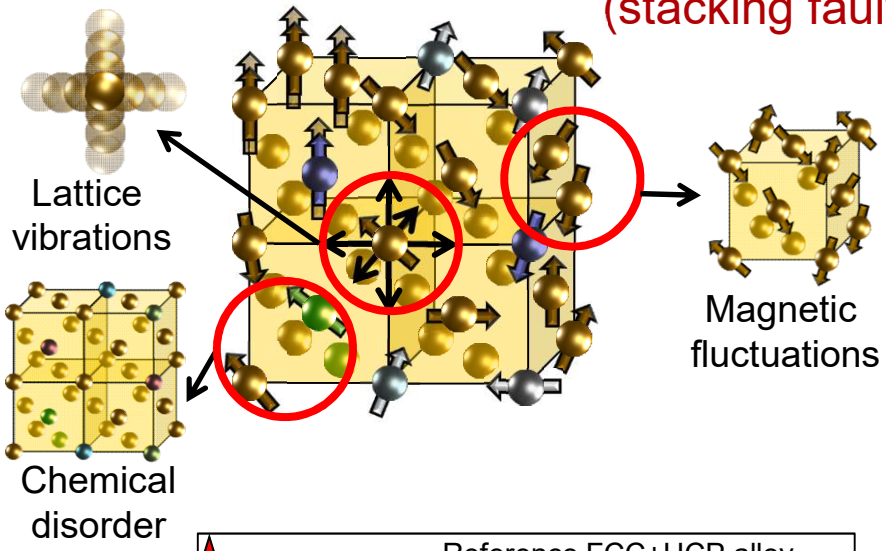
Keep TRIP + introduce more mechanisms

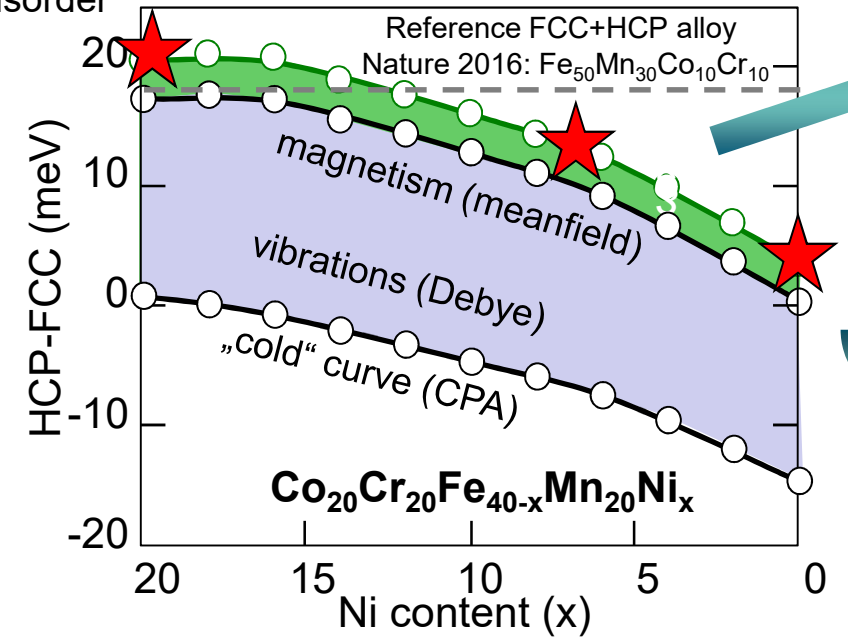
Keep TRIP: Quinary TRIP-iCCAs - related preliminary work

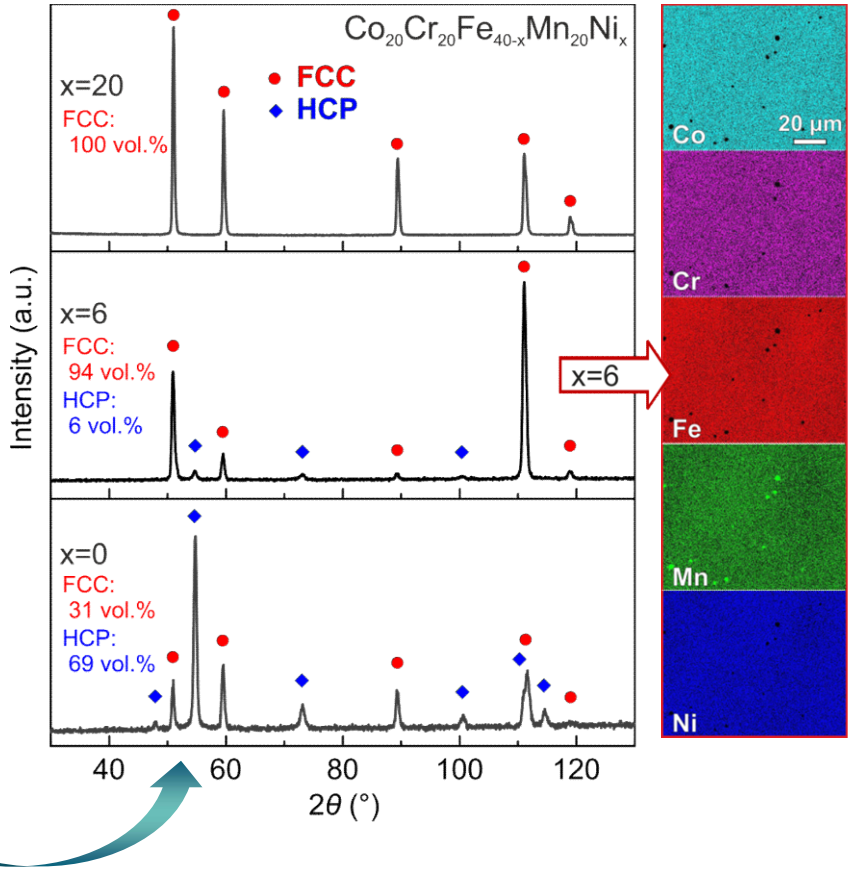
Finite-temperature ab initio

HCP – FCC
(stacking fault energies)

Macro- and Micro-scale experiments







Ab initio design of **TRIP** quinary compositionally complex alloys

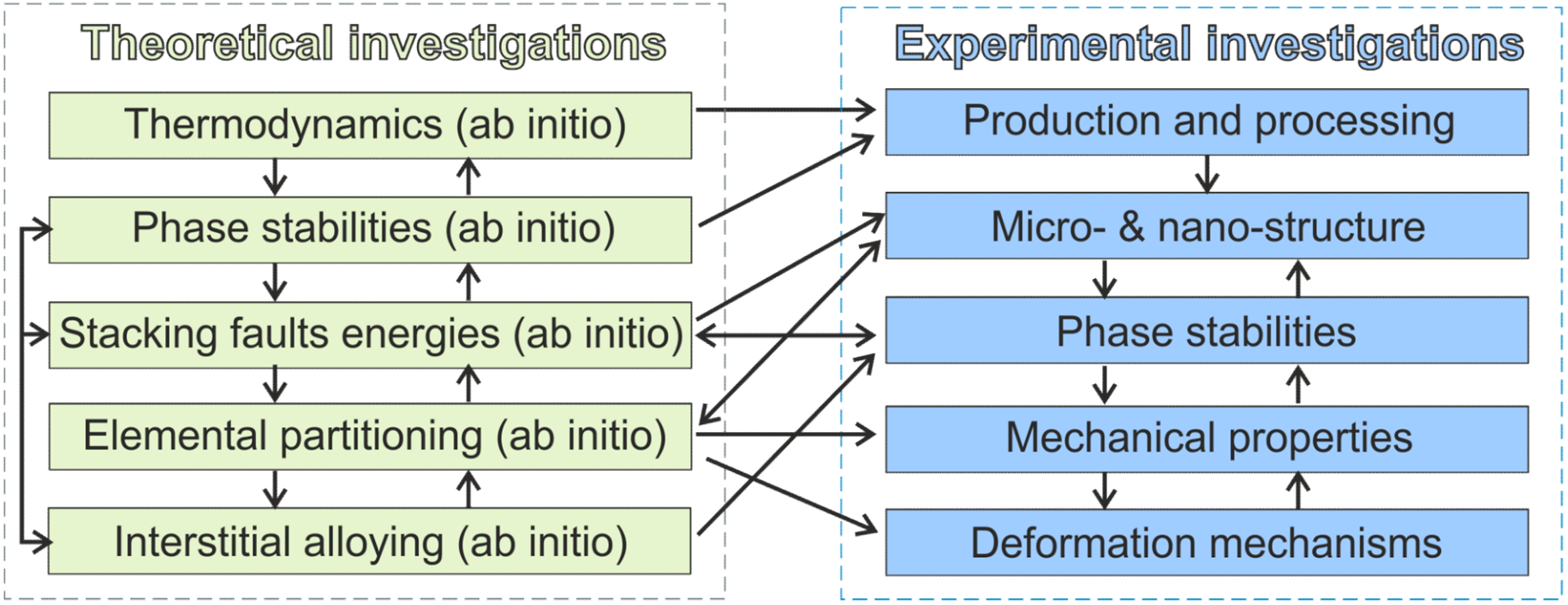
Quinary TRIP-iCCAs: aims and the work program

Quinary TRIP-iCCAs

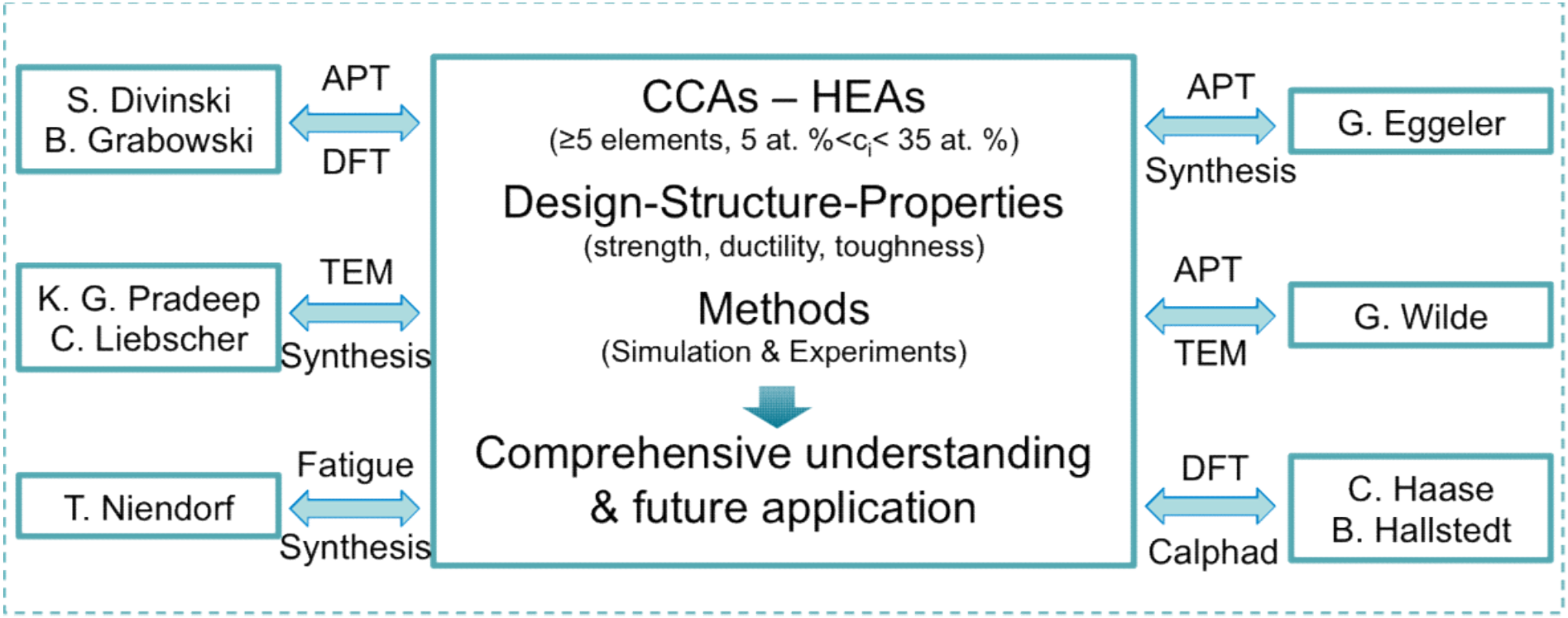
$Co_{20}Cr_{20}Fe_xMn_yNi_z$ (5<x,y,z<35) + (C,N)

SS: solid solution

- Massive substitutional SS (quinary)
- Interstitial SS (iCCAs)
- TRIP & TWIP (metastability)
- Nano-precipitation (iCCAs)
- Dislocations & grain boundaries

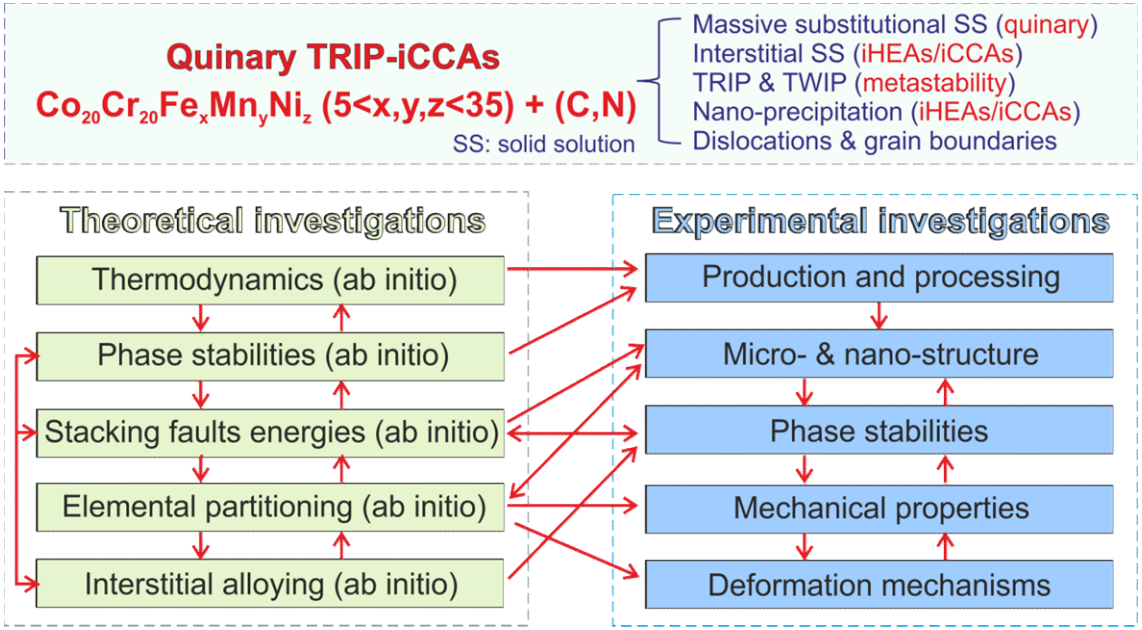


Crosslinks to other projects in the SPP



Thank you!

Quinary TRIP-iCCAs: aims and the work program



WP1: Phase stabilities, stacking fault energies and thermodynamic properties of quinary TRIP-CCAs

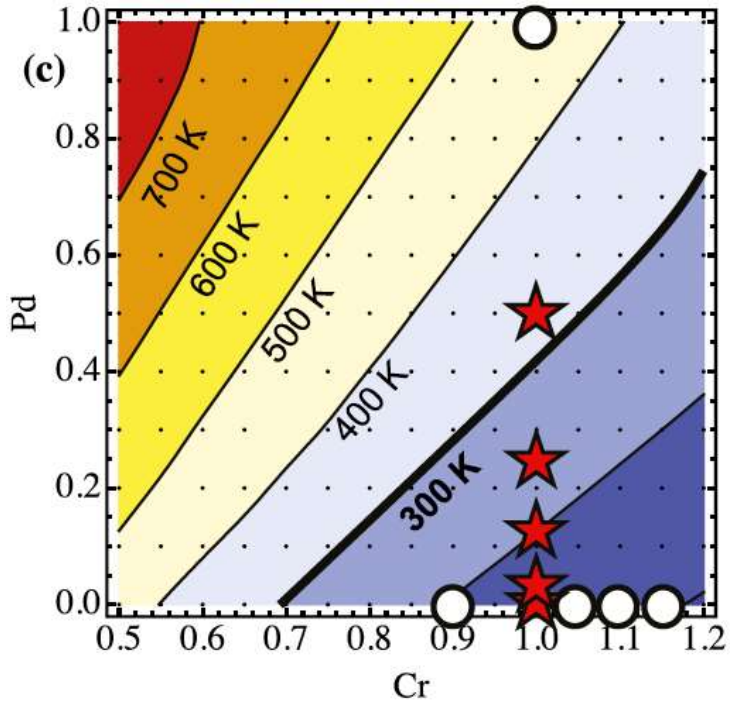
WP2: Interstitial atoms effects on phase stabilities and stacking fault energies

WP3: Elemental partitioning in quinary TRIP-iCCAs

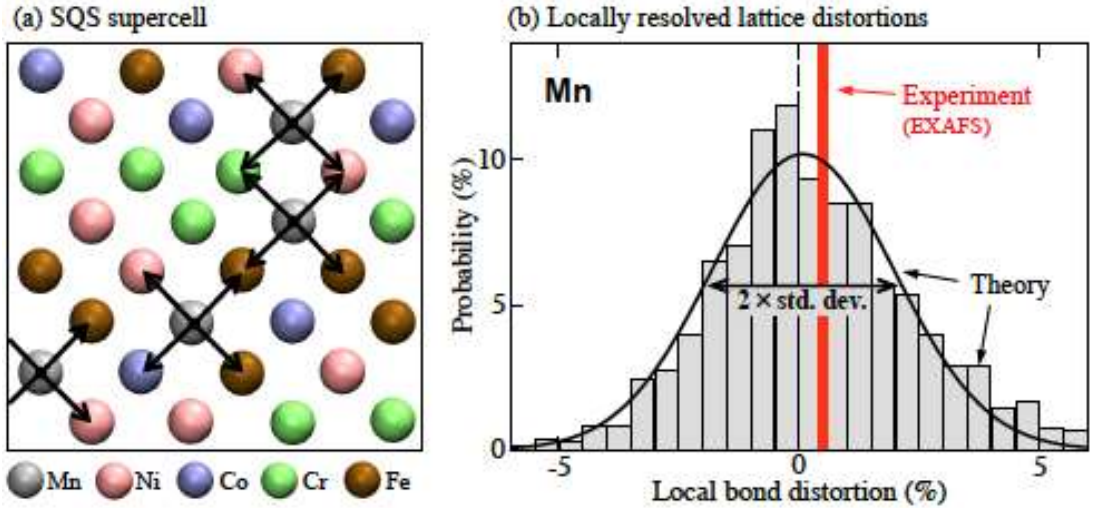
WP4: Alloy production and processing

WP5: Micro- and nanostructure of the novel alloys as well as their phase stabilities

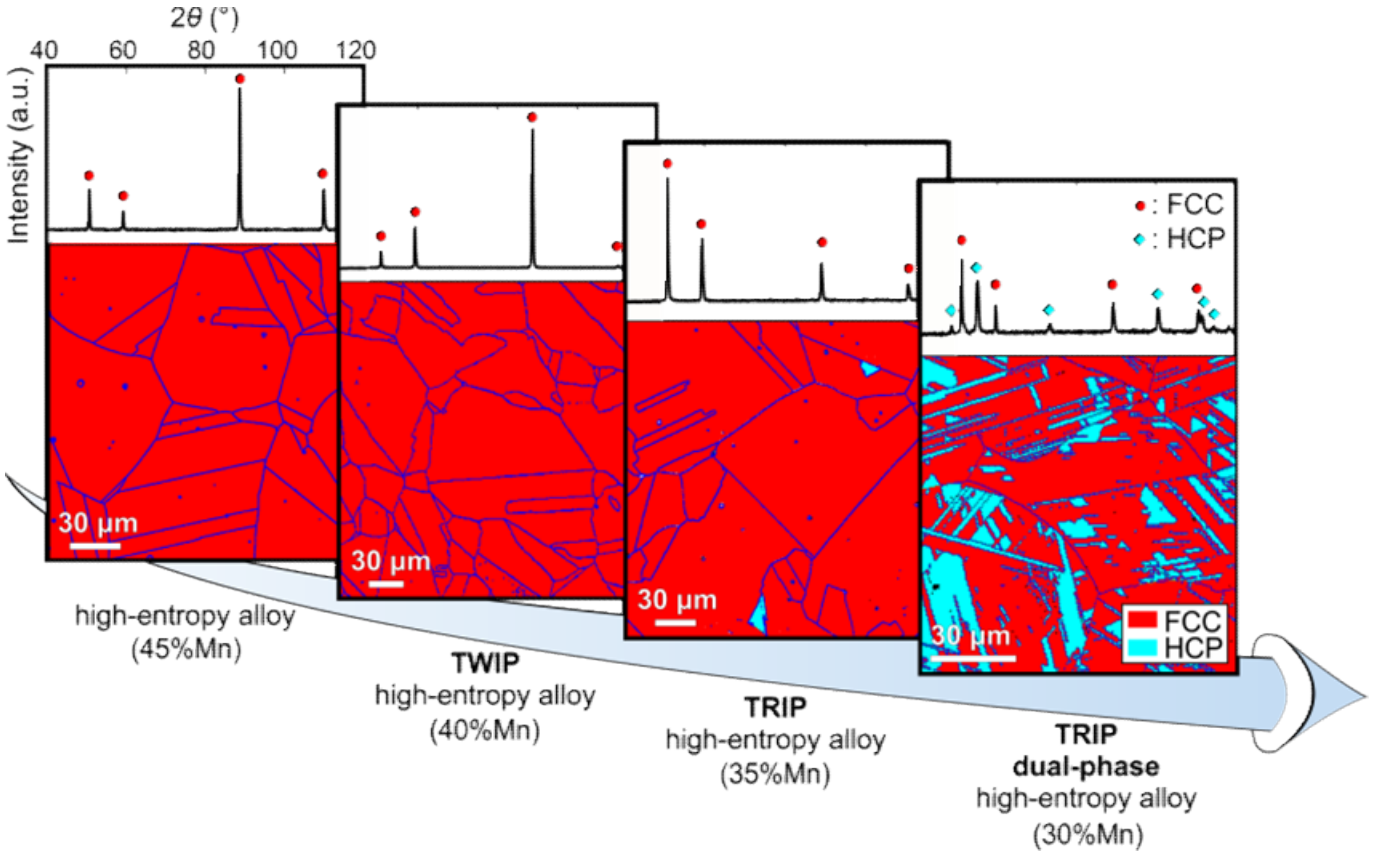
WP6: Mechanical behavior and the underlying mechanisms



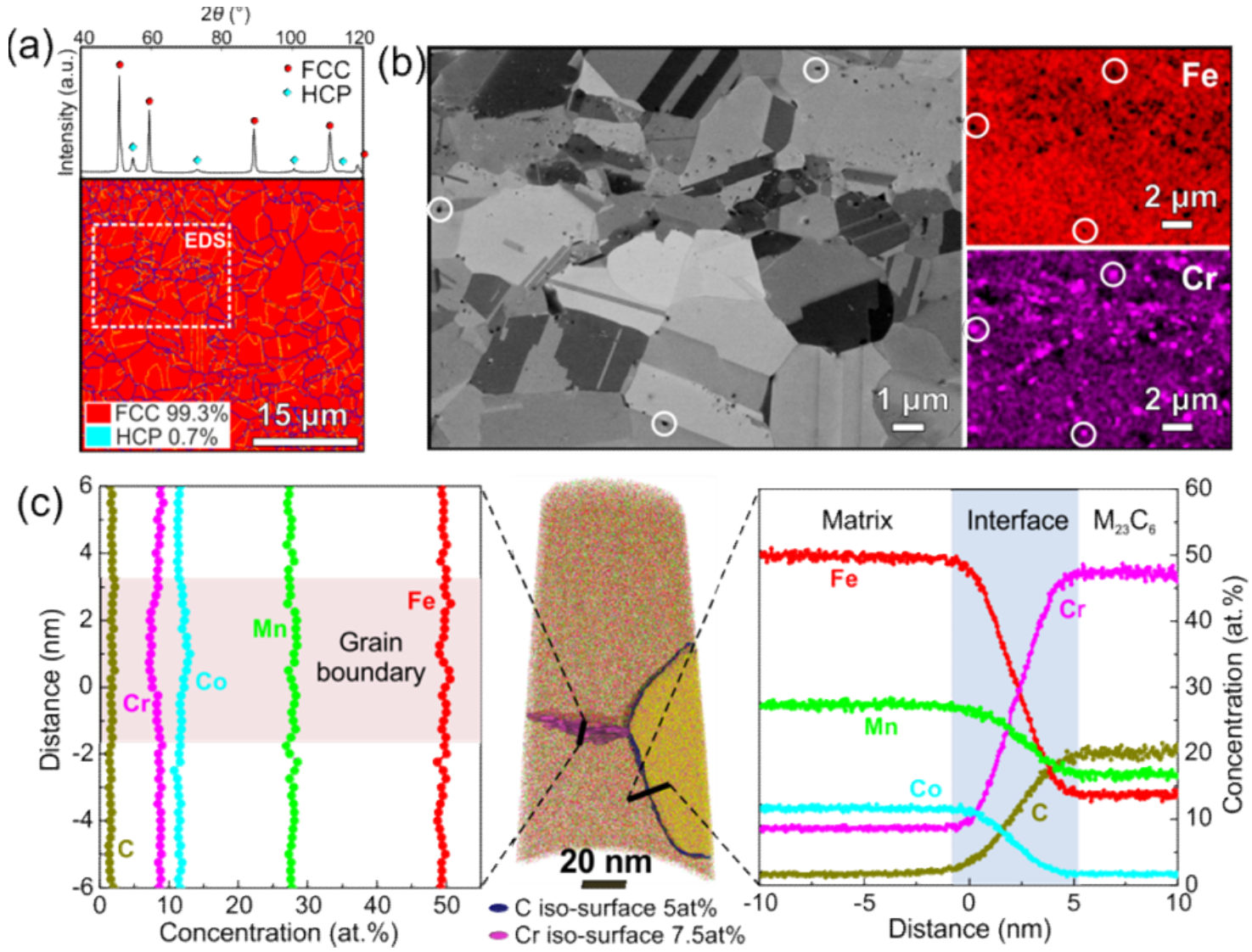
"Treasure map" for Curie temperatures of FeCoNiCrxPdy alloys



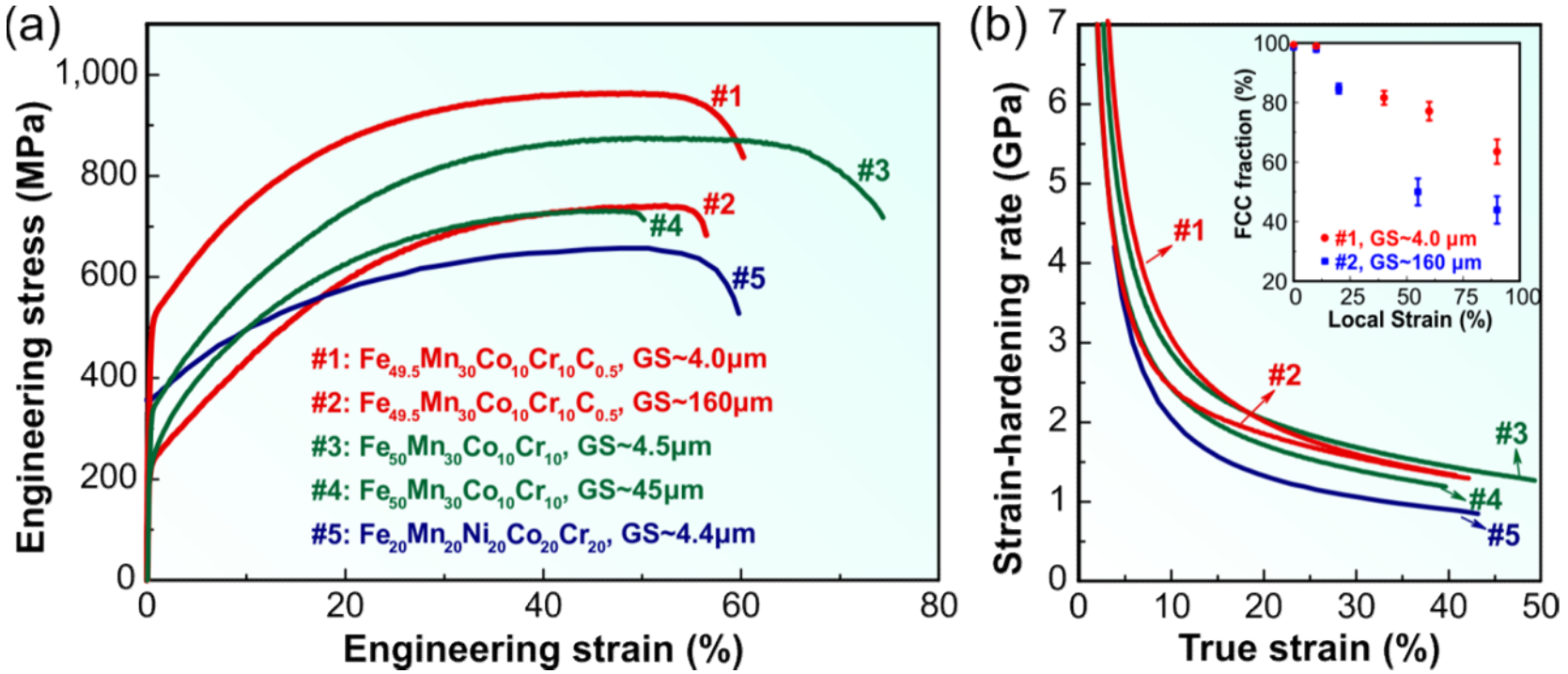
Lattice distortion in HEAs/CCAs



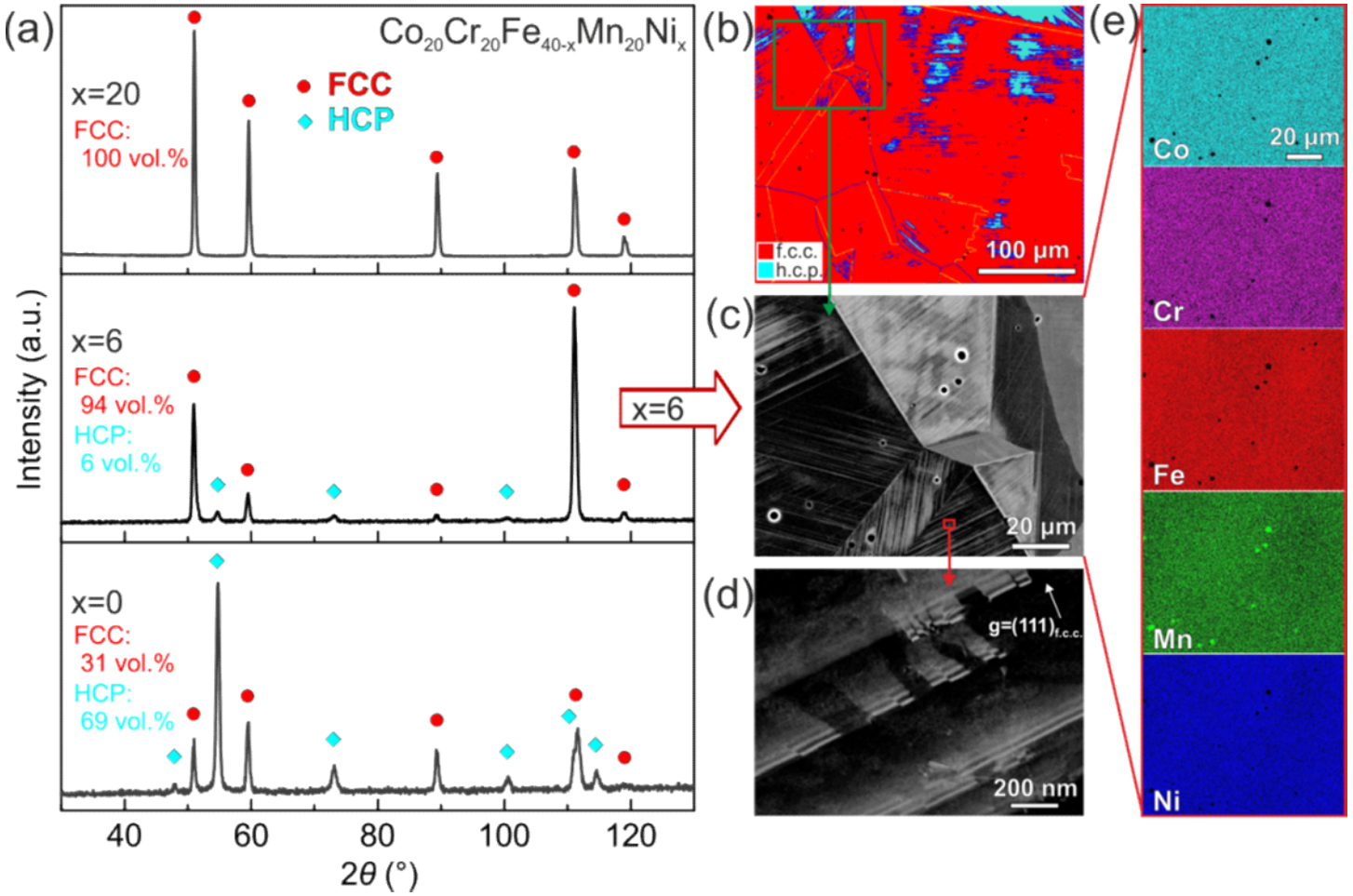
$Fe_{80-x}Mn_xCo_{10}Cr_{10}$ (x=45, 40, 35 and 30 at.%)



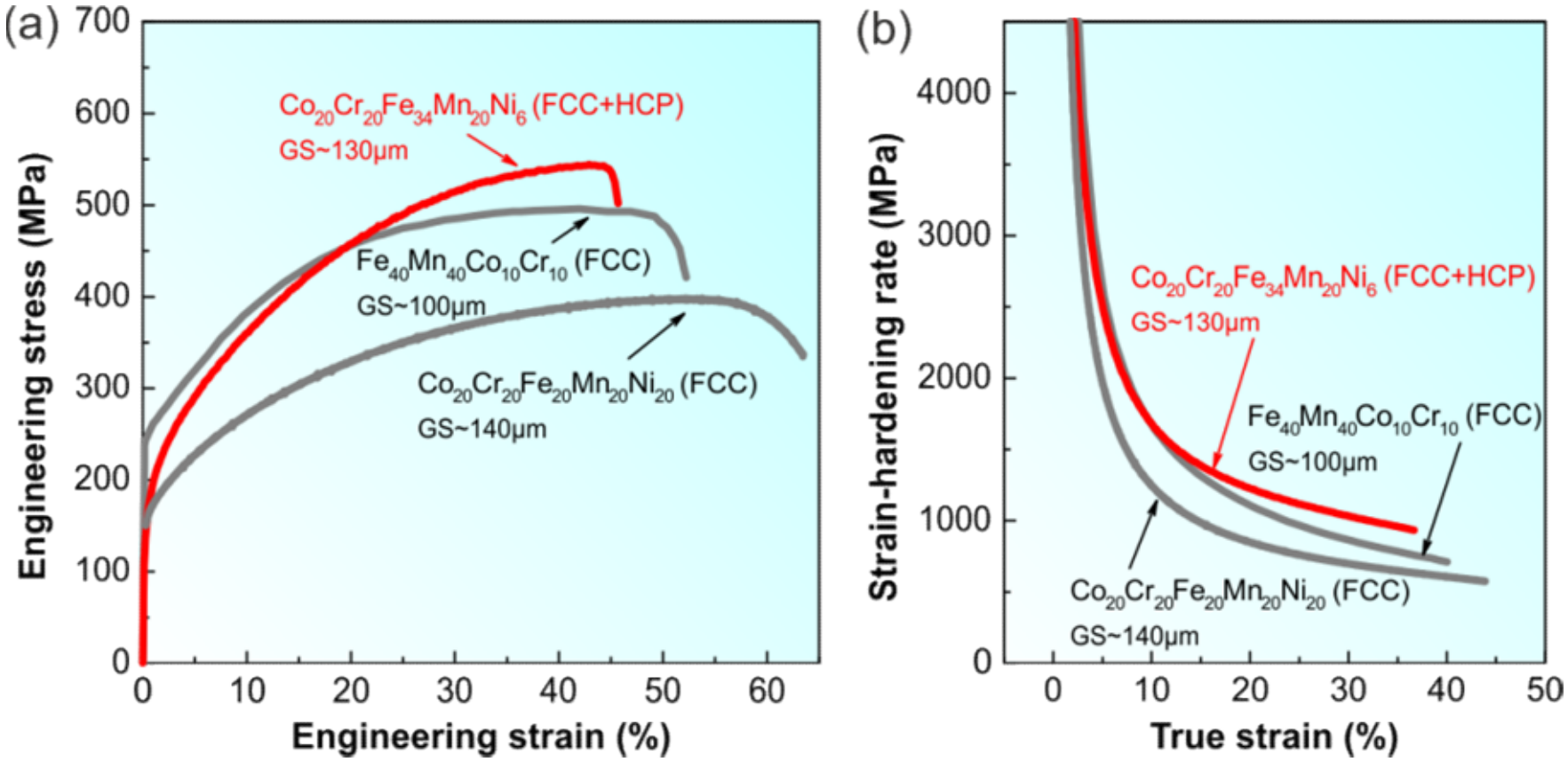
Microstructure and elemental distribution in a grain-refined iCCA



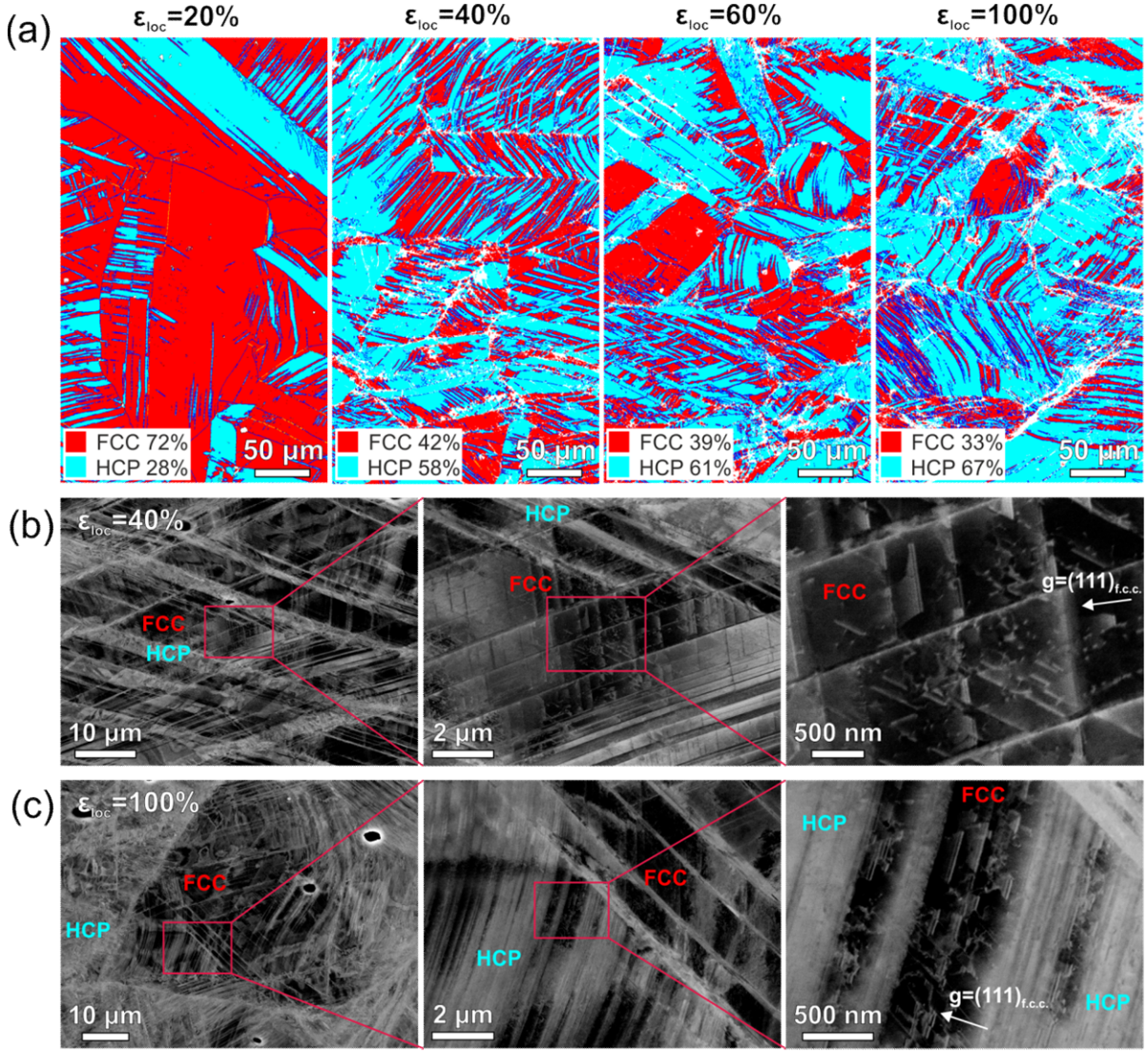
Mechanical behavior of various CCAs/HEAs



Microstructure and elemental distribution in the $Co_{20}Cr_{20}Fe_{40-x}Mn_{20}Ni_x$ (x=20 at%, 6 at% and 0) CCAs/HEAs

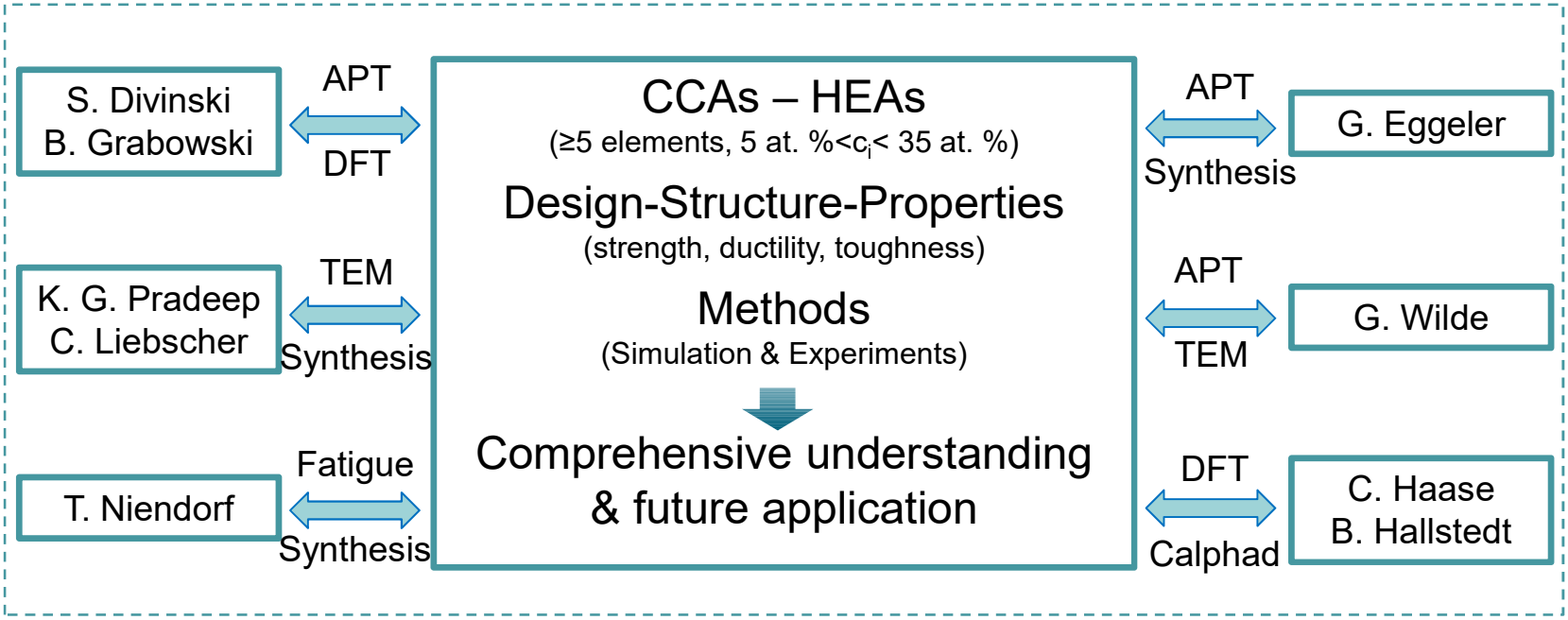


Mechanical behavior of the quinary dual-phase $Co_{20}Cr_{20}Fe_{34}Mn_{20}Ni_6$ CCA compared to various quaternary and quinary single-phase HEAs



Deformation micro-mechanisms in the quinary dual-phase $Co_{20}Cr_{20}Fe_{34}Mn_{20}Ni_6$ CCA with increasing tensile deformation at room temperature

Crosslinks to other projects in the SPP



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