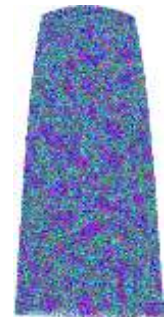
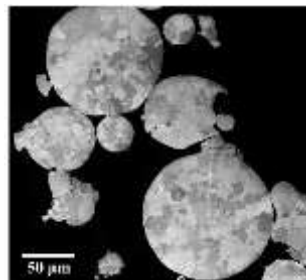
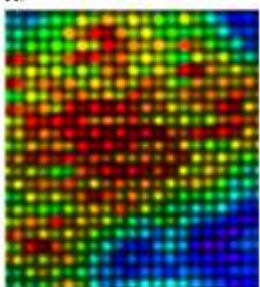


High-resolution characterization of CCA powder particles

Nicolas J. Peter

Eric Gärtner, Volker Uhlenwinkel, Eric A. Jägler, Gerhard Dehm

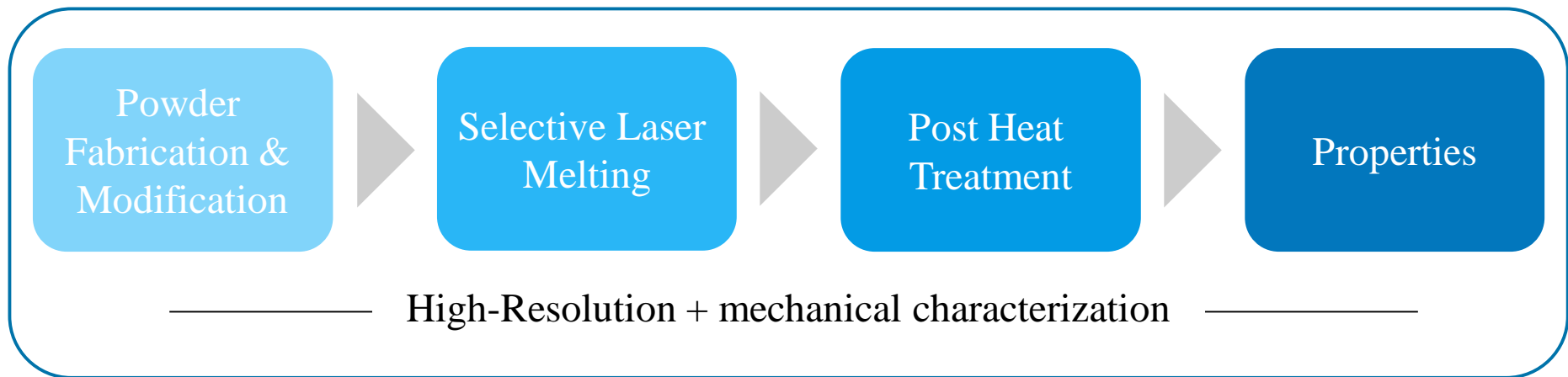


February 14th, 2018

PaCCman ...

Particle strengthened Compositionally Complex Alloys

interlinking powder synthesis, additive **manufacturing**, **microstructure evolution and deformation mechanisms**

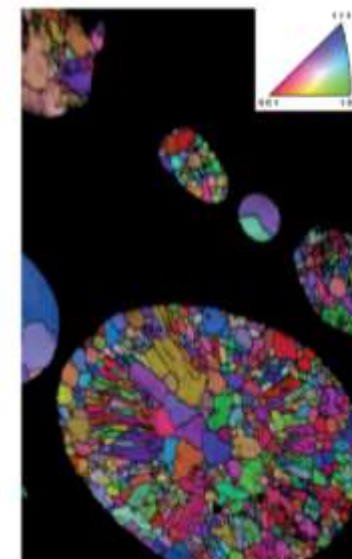
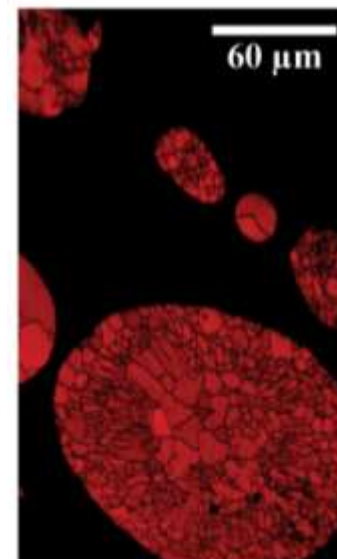
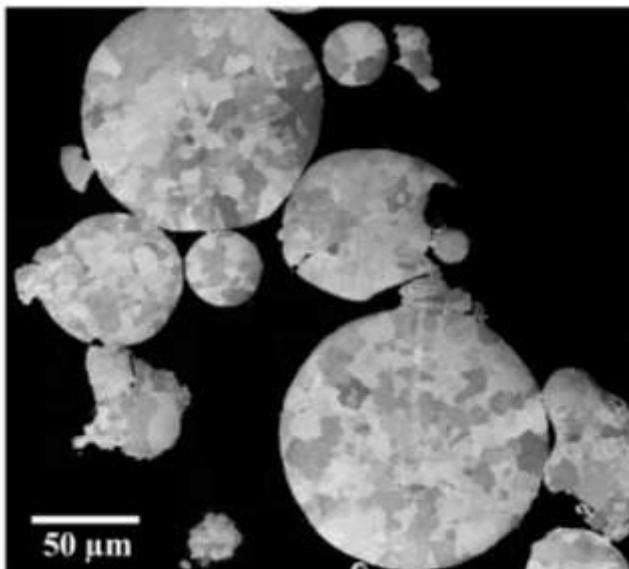
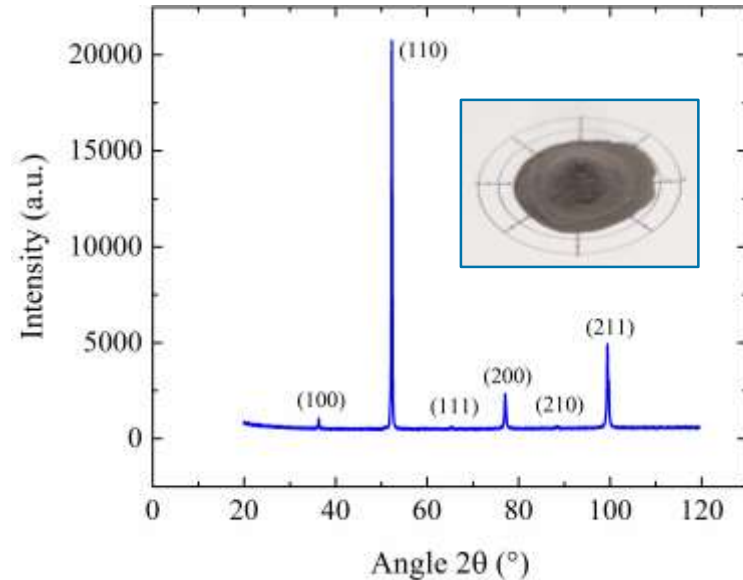


We aim for SLM microstructures determined by the powder

Powder of nominal composition:



Polycrystalline powder particles
XRD and EBSD indicate **B2** single phase

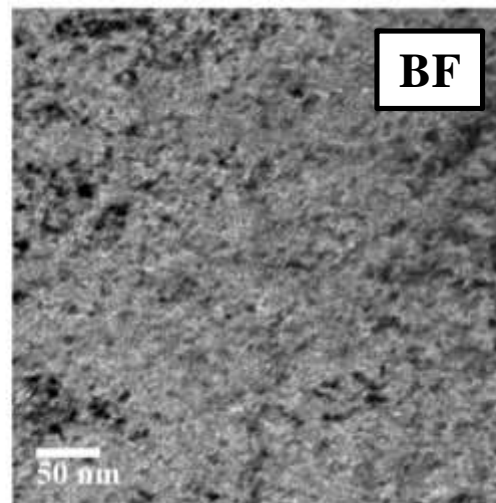
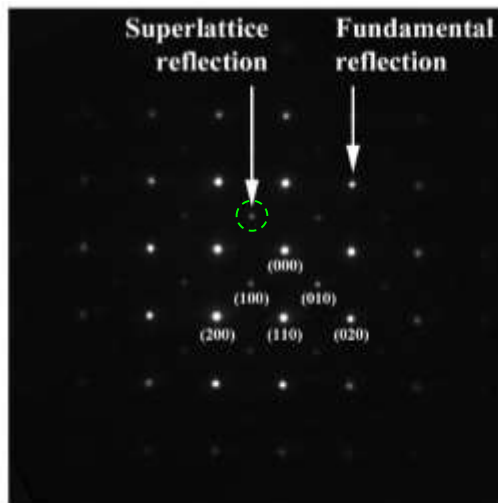
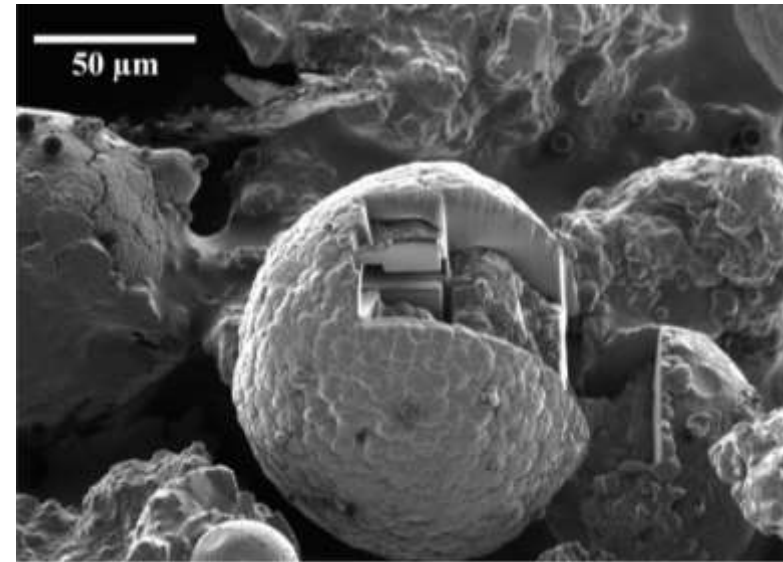


Conventional TEM:

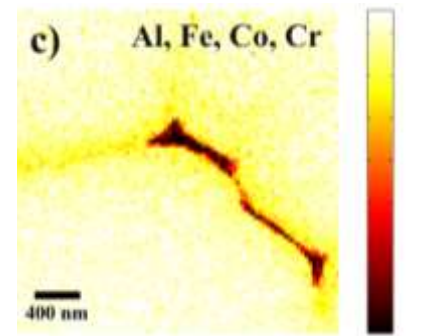
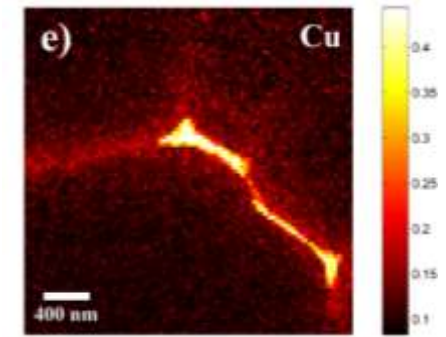
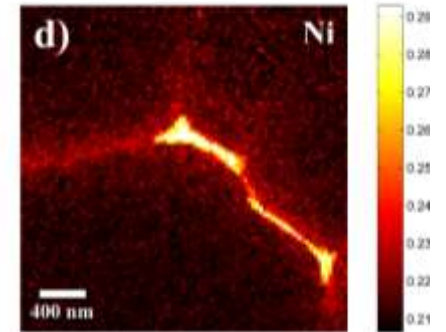
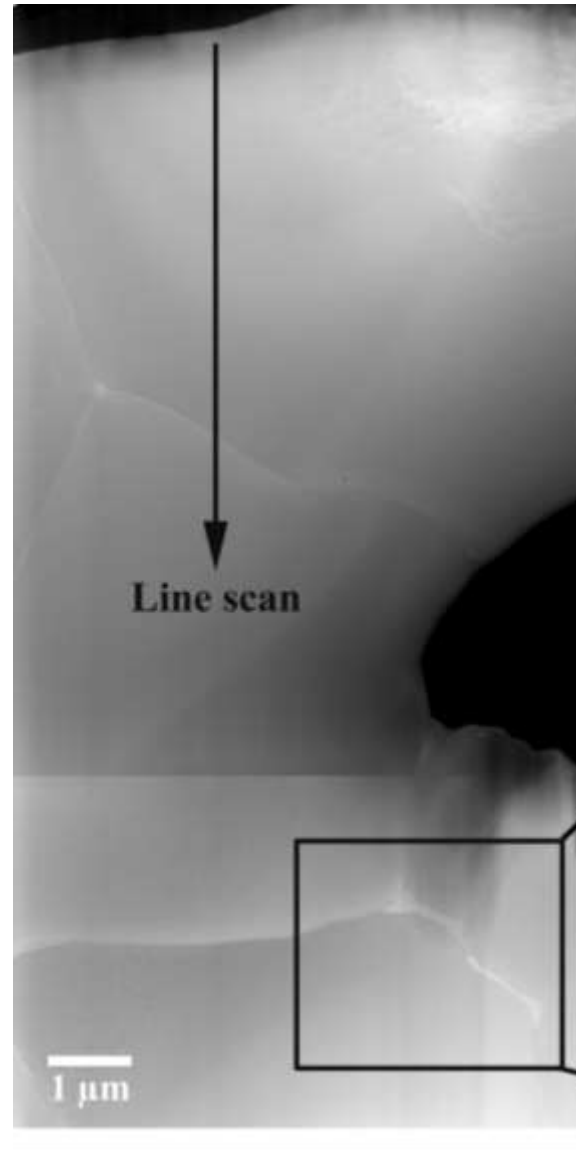
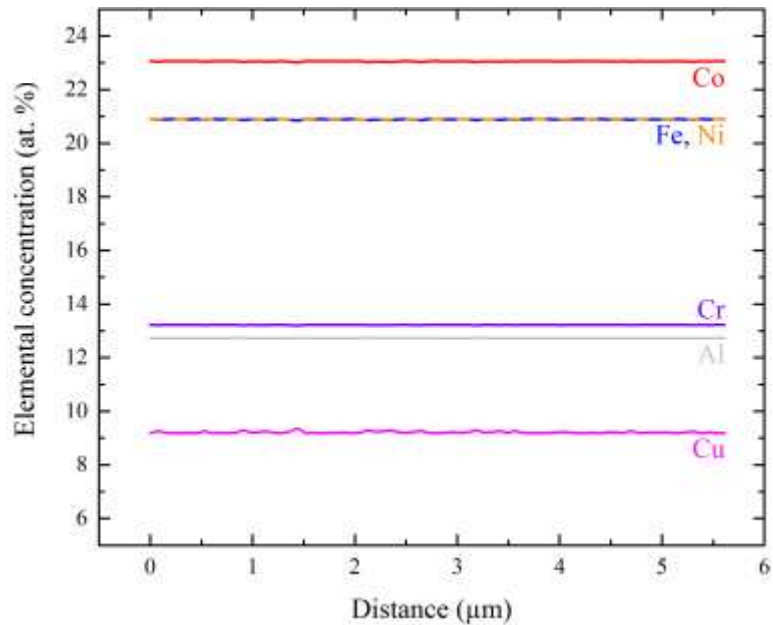
B2 diffraction pattern

Meander-like structure in DF images
with wavelength of 5.78 ± 3.81 nm

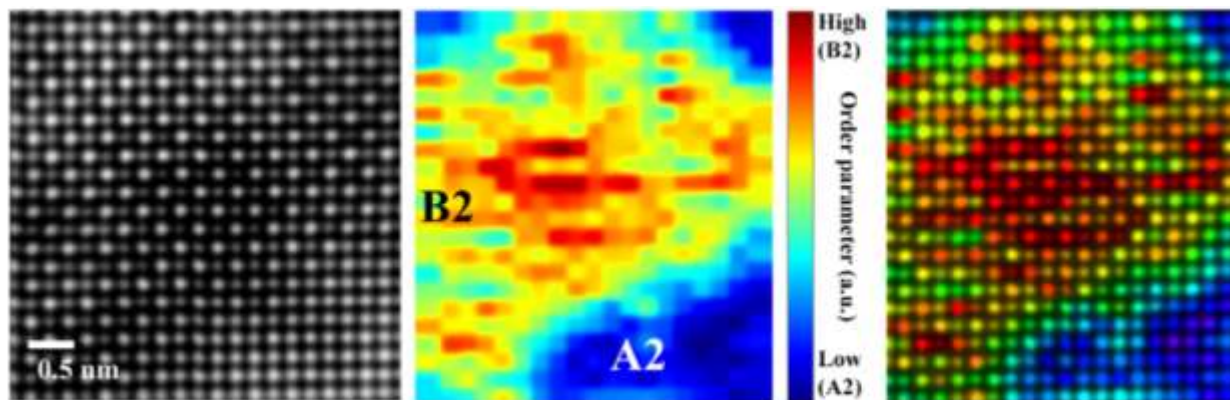
Phase separation?



EDS of lower magnification:
Homogeneous grain interior &
CuNi-rich grain boundary phase



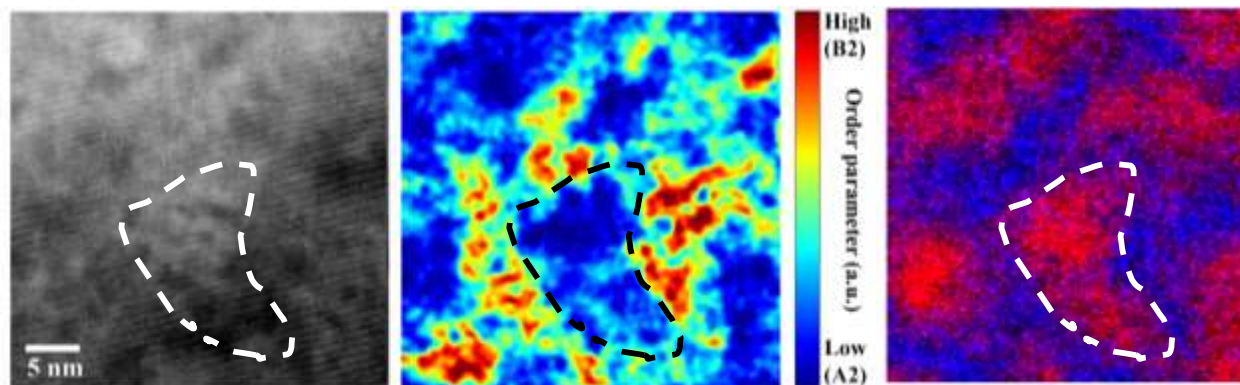
HAADF
STEM
[001]



EDS of higher magnification:

Chemical and structural ordering into A2 / B2 compartments
High coherency

HAADF
STEM
[001]

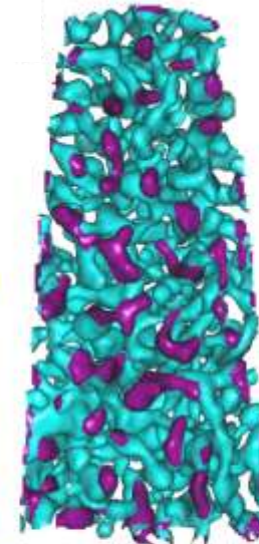
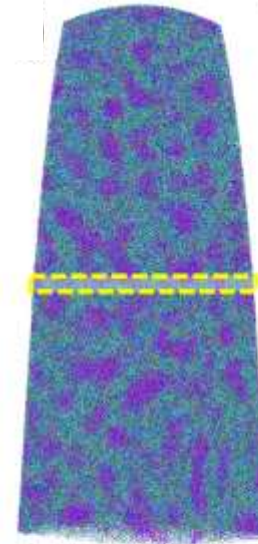
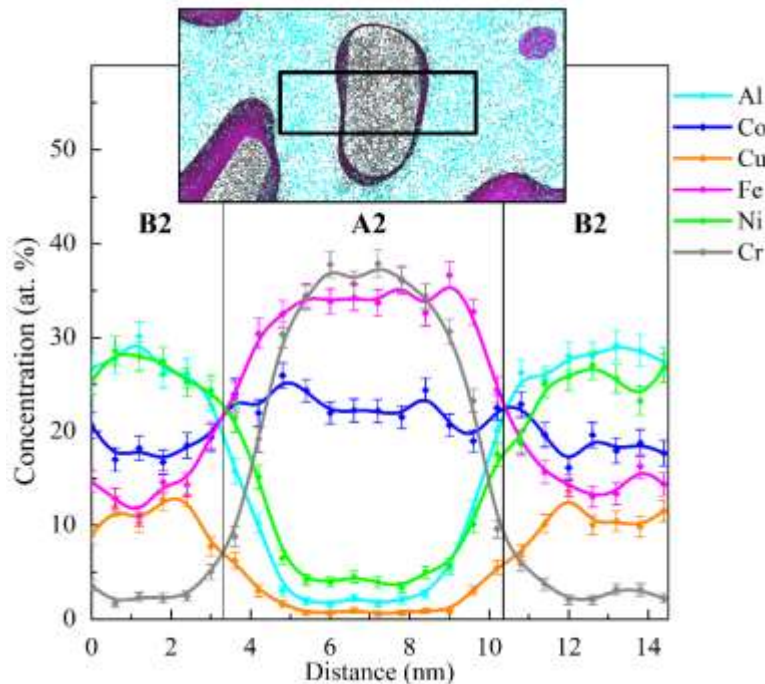


EDS
STEM
A2 / B2

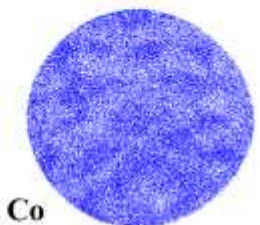
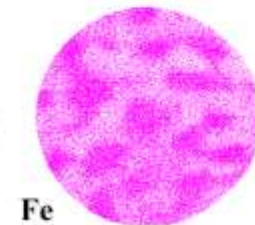
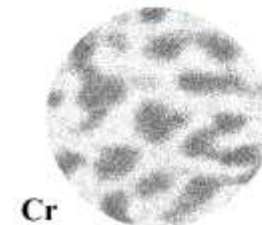
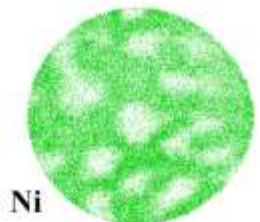
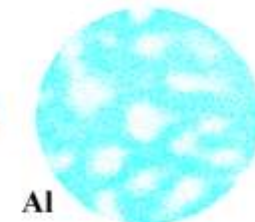
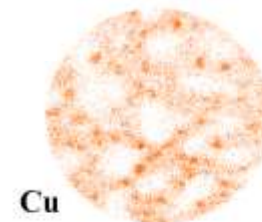
3D-APT:

Phase composition of
interwoven A2 / B2 regions

High Cu cluster density in B2 phase



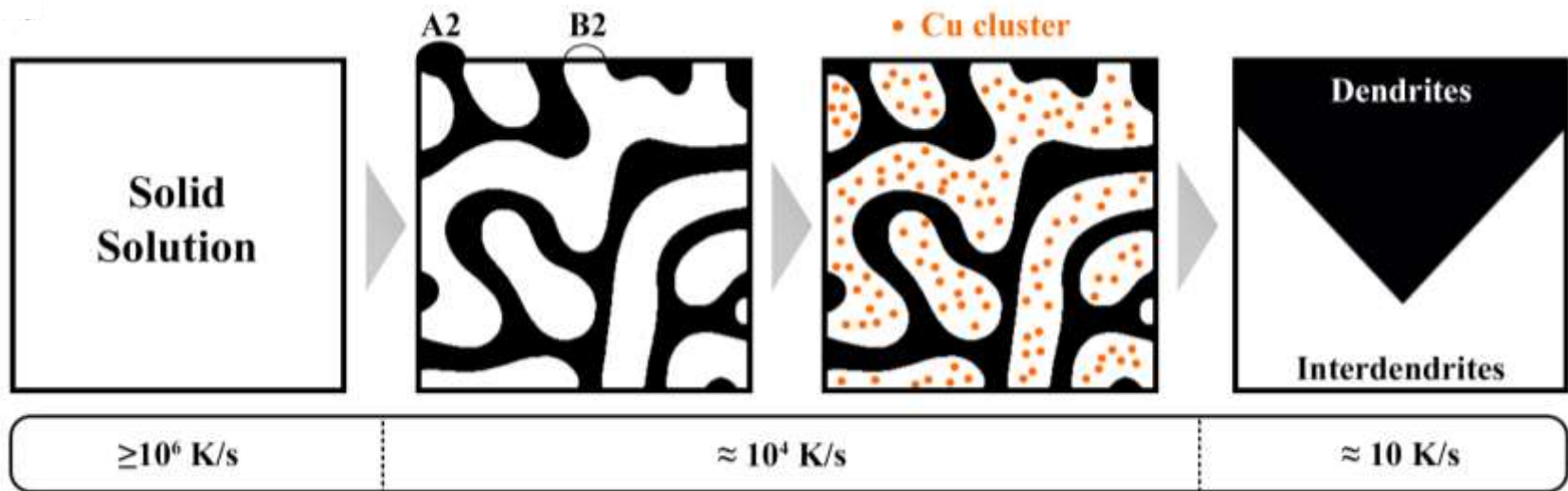
● Al ● Fe ● Cr ■ iso - Al + Ni 30 at.% ■ iso - Cu 20 at.%
● Co ● Ni ● Cu ■ iso - Fe + Cr 49 at.%



50 nm

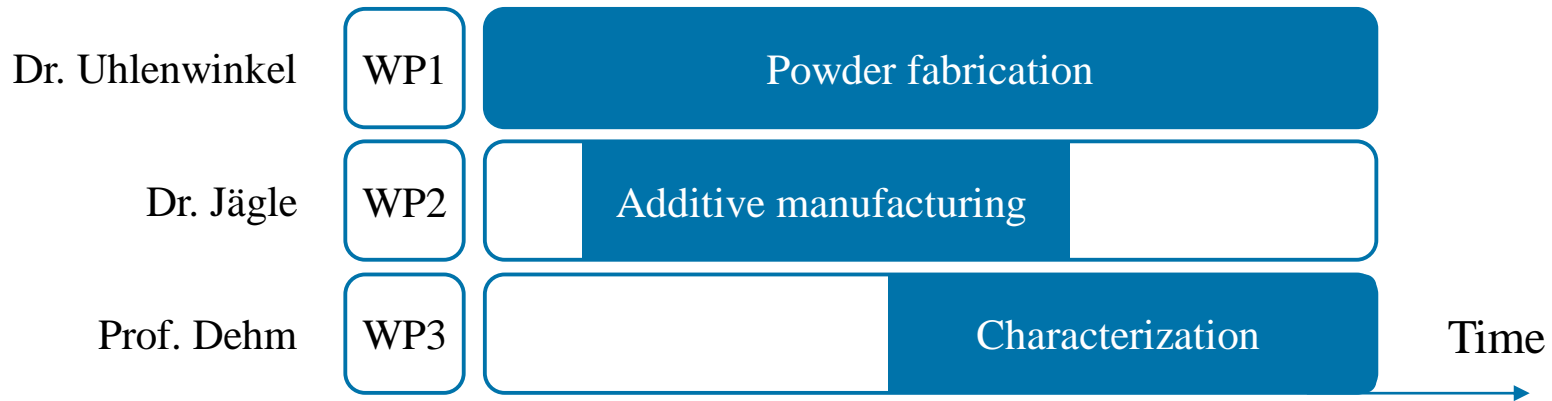
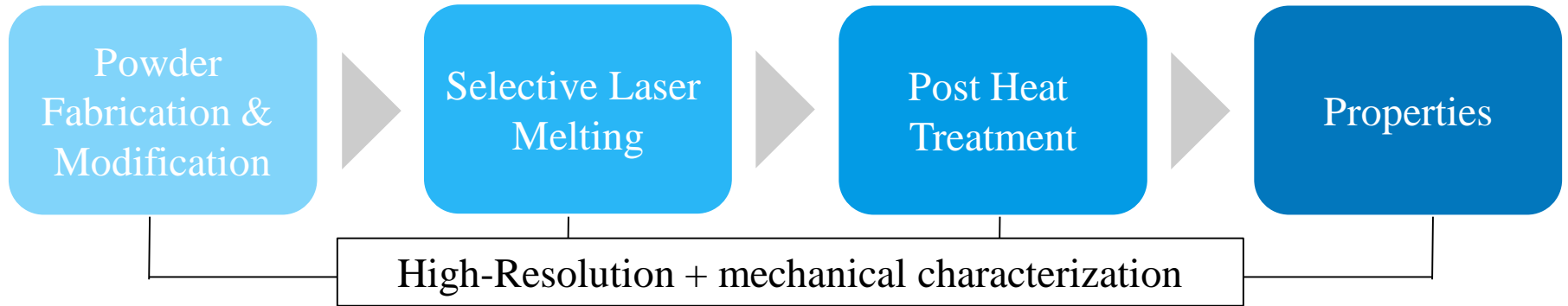
Cooling rate and alloy composition ($\text{AlCu}_{0.5}\text{NiFeCoCr}_{0.75}$) allow for
Extension of phase evolution model

Conditional spinodal decomposition (A2 / B2) & nucleation & growth (Cu clusters)



S. Singh et al. (2011)
M.V. Ivchenko (2016)

S. Singh et al. (2011)
M.V. Ivchenko (2016)



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PaCCman  ...

Prof. Glatzel



Dr. Uhlenwinkel



Prof. Dehm

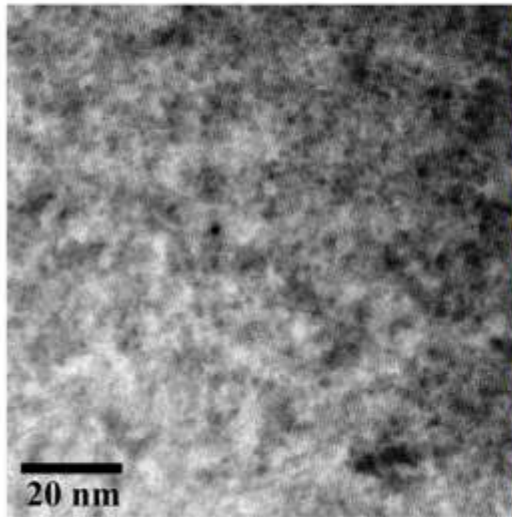


Dr. Jäggle

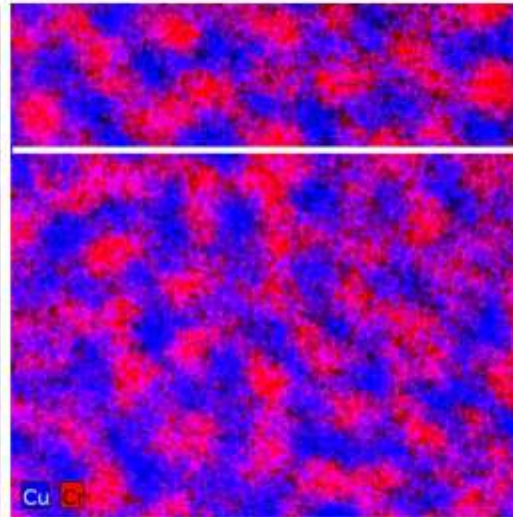


MAX-PLANCK-INSTITUT FÜR EISENFORSCHUNG

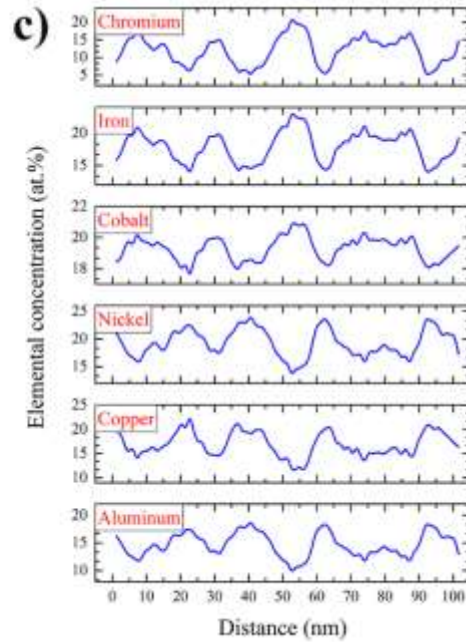
a)



b)



c)



Cylinder used for the shown concentration profile
Diameter = 5nm, Length = 15 nm

