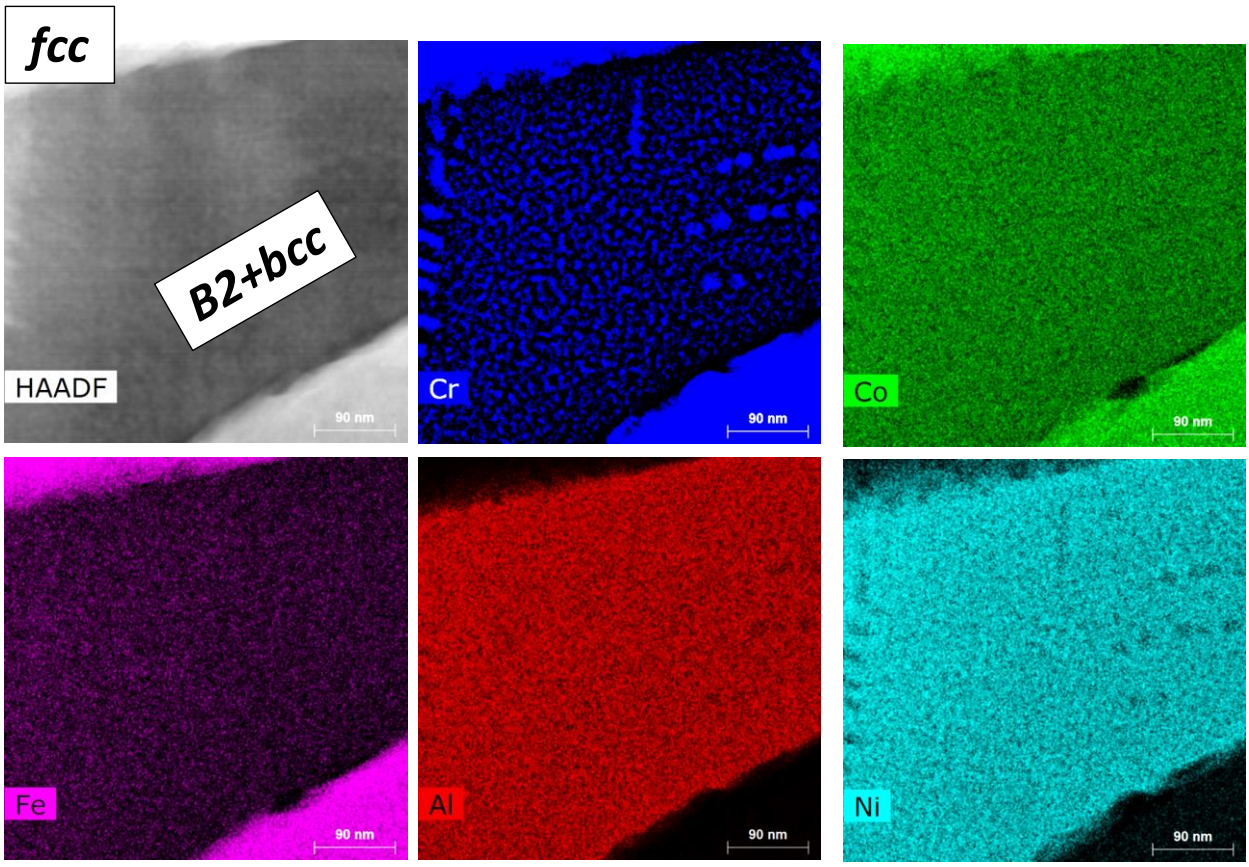
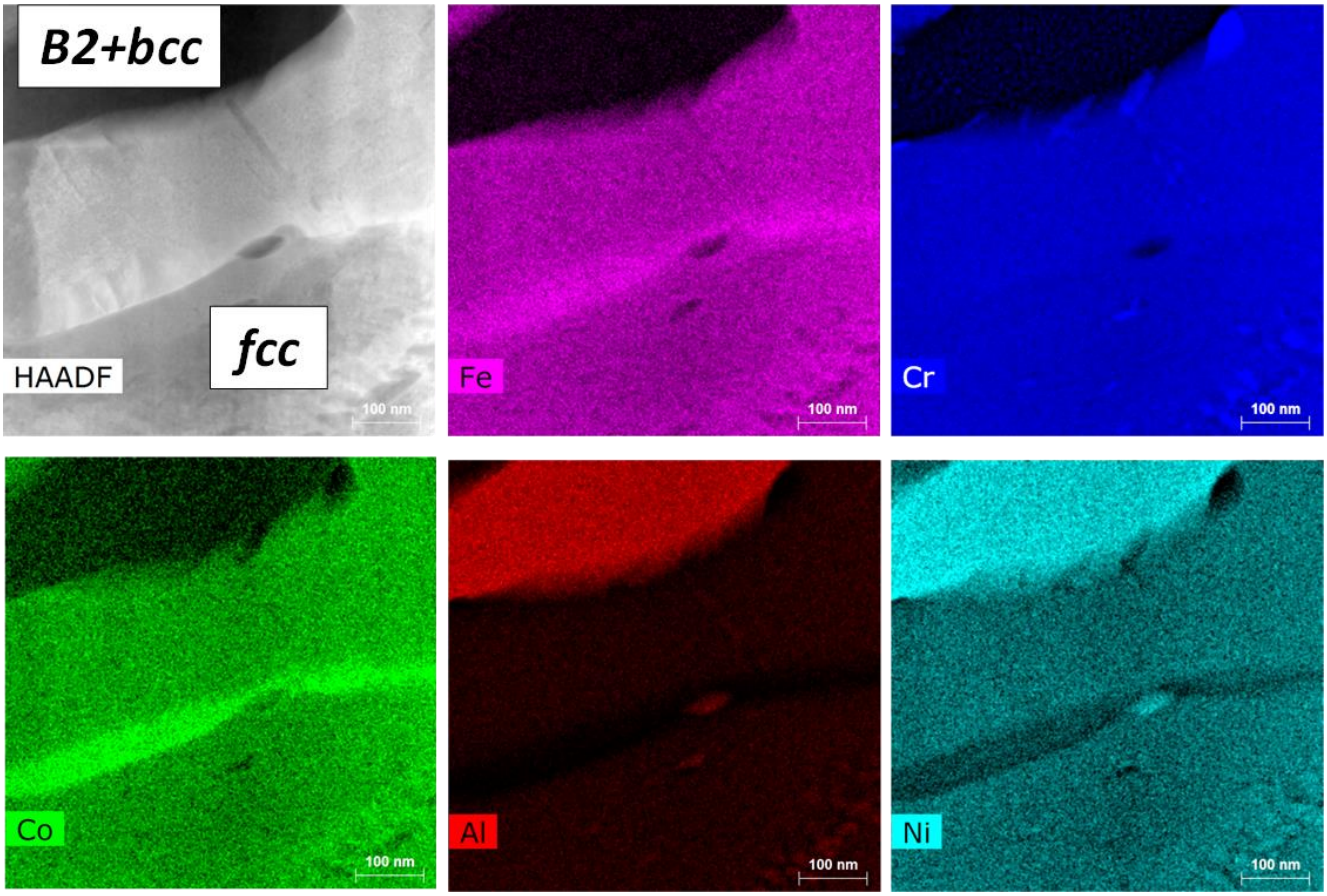


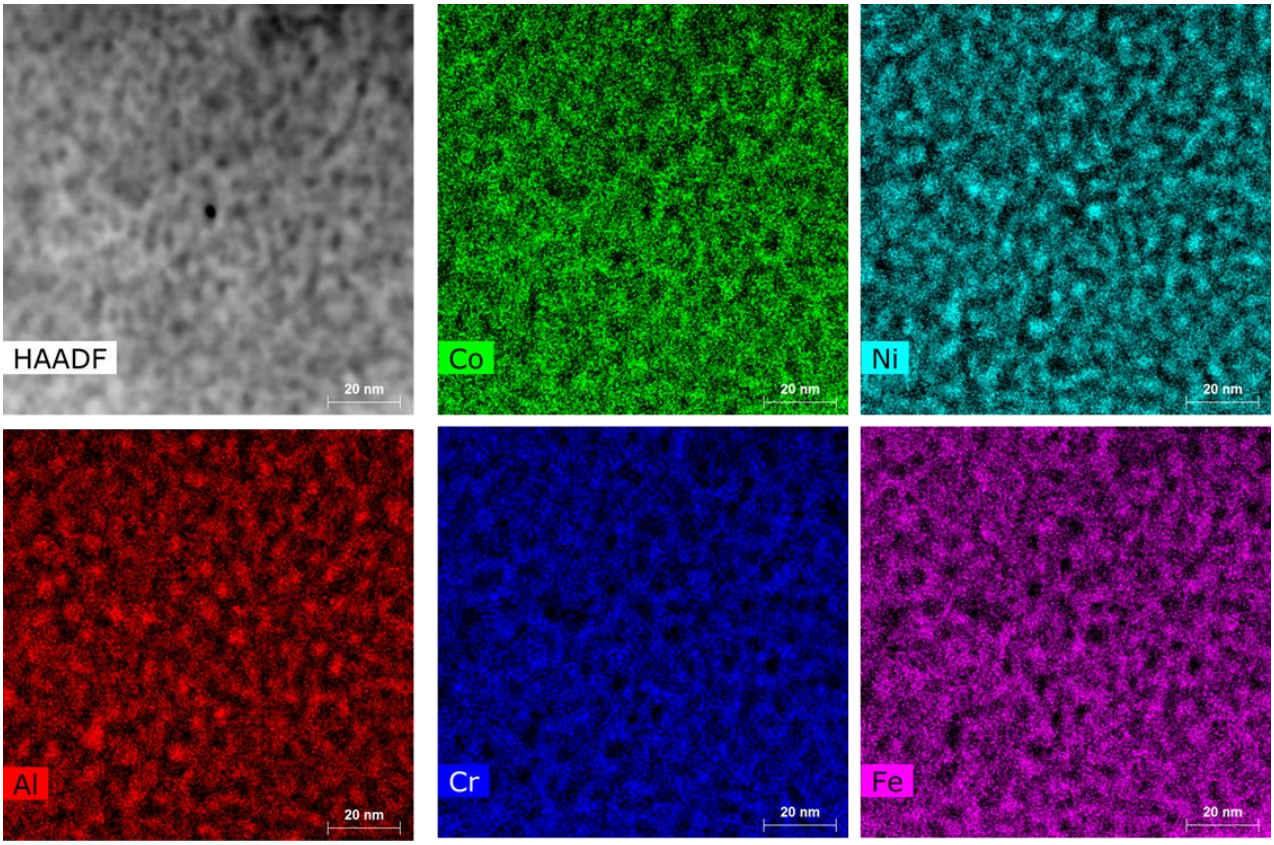
Supplementary Figure 1

STEM EDS maps from the HTA condition showing the compositional partitioning in a region with a magnified view of *fcc* and B2 phase. The dark contrast phase in the STEM image is B2 phase (over all rich in Al and Ni), high density nano-scale bcc precipitates can be clearly seen in the Cr map shown in blue color.



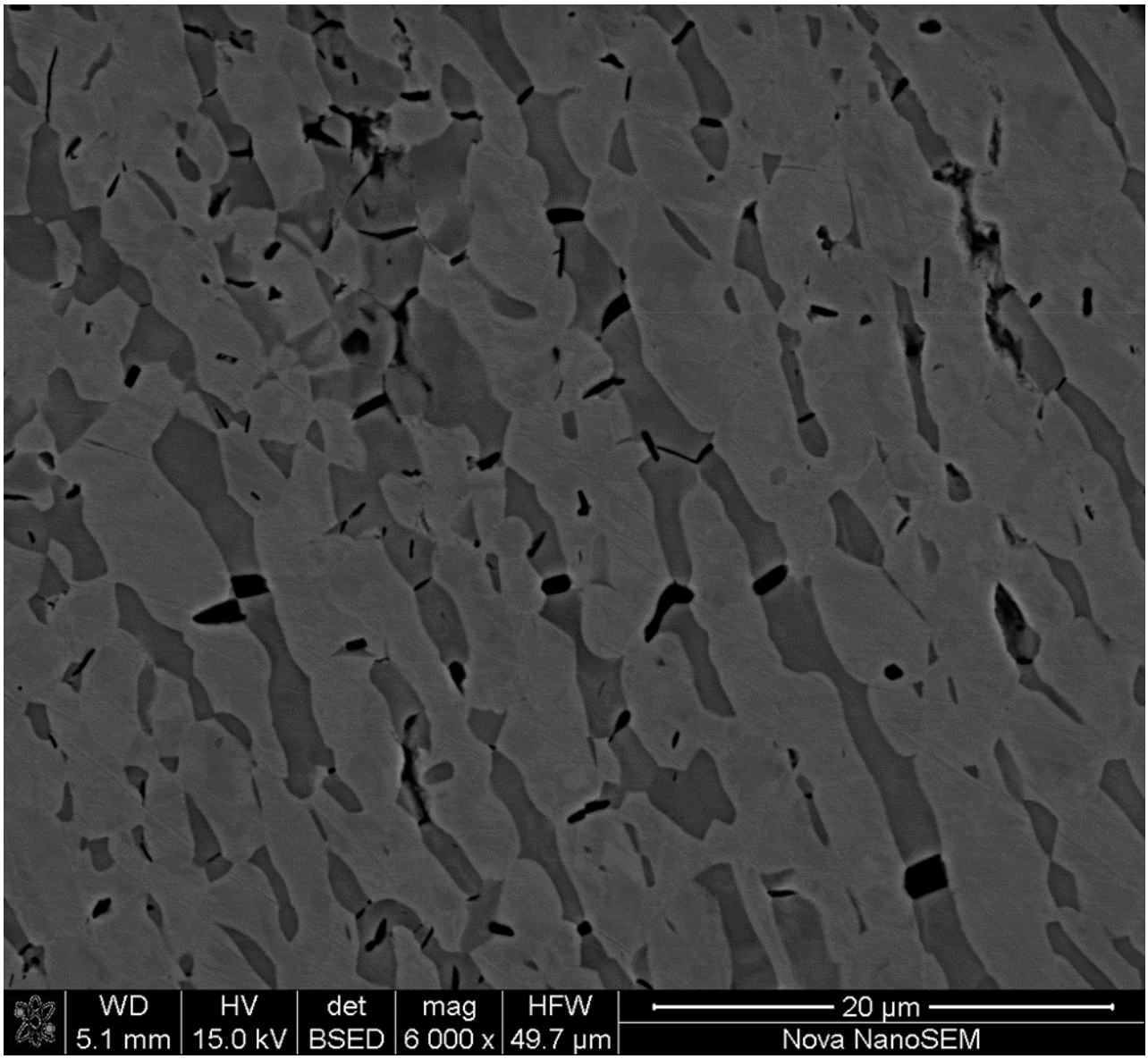
Supplementary Figure 2

STEM EDS maps from the HTA condition showing the compositional partitioning in a region with a magnified view of *fcc* and B2 phase. The grey/bright contrast phase in the STEM image is fcc phase which is rich in Co, Cr and Al. No compositional fluctuation is evident in *fcc* phase in this heat treatment condition of the alloy.



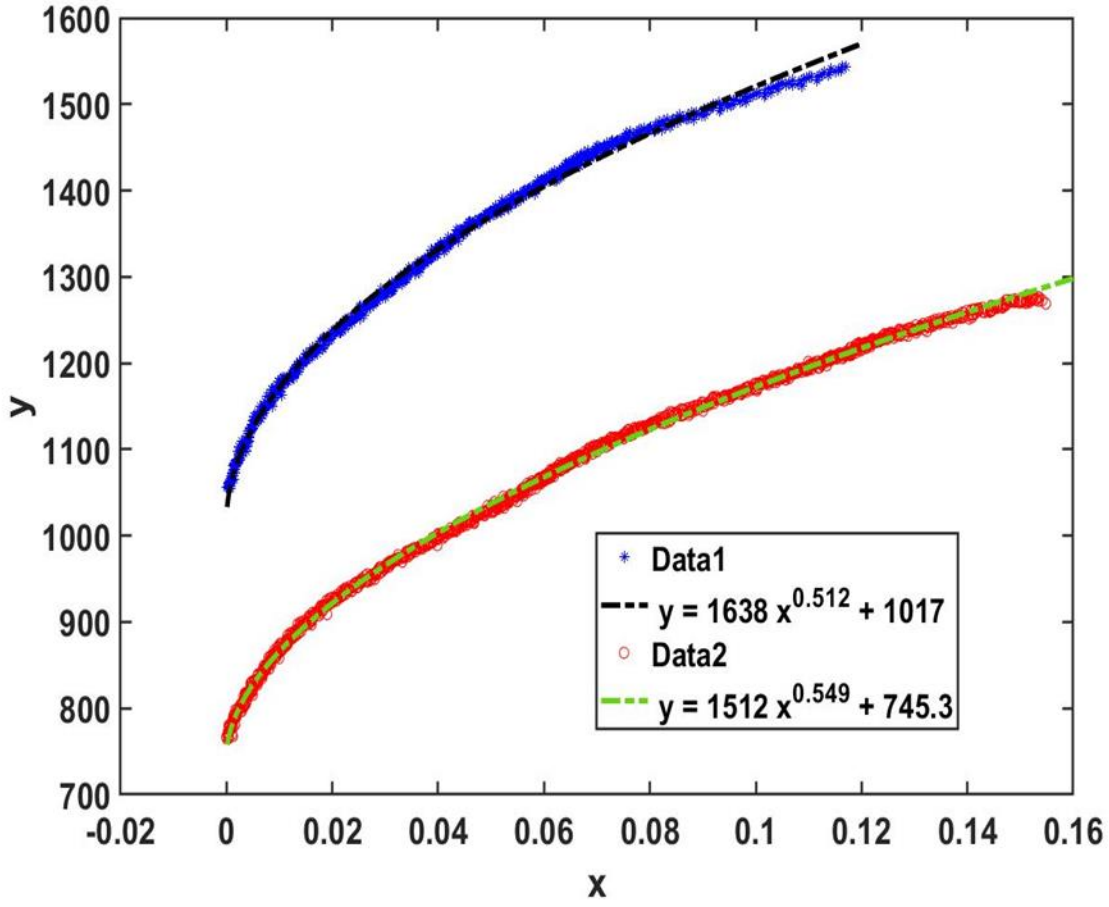
Supplementary Figure 3

STEM EDS maps from the HTA-580 condition showing the compositional partitioning in a region with a magnified view of *fcc* phase. The compositional fluctuations are evidently seen in *fcc* phase in STEM image (bright and dark contrast). The Al-Ni rich regions correspond to the $L1_2$ phase formed in this condition after the heat treatment at 580 ^{o}C for 24 h.



Supplementary Figure 4

SEM image from the fracture HTA:40psi sample. Note that the cracks are limited in the dark contrast B2 phase and are broadened to accommodate the plastic flow in fcc phase.



Supplementary Figure 5

Curve fitting using the equation $\sigma=k\varepsilon^n$ (power law) for true stress-strain curve for HTA and HTA-580 condition.