# EFFECT OF Co-CONTENT ON MICROSTRUCTURE AND PHASES OF LASER ADDITIVE MANUFACTURED $Co_X(CrNi)_{100-X}$ ALLOY

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The medium entropy alloy CoCrNi has been considered a potential alloy for cryogenic to high-temperature structural applications, and it has excellent fatigue performance. Laser directed energy deposition (LDED) opens new avenues for fabricating complex components of CoCrNi with ease and without any defects, with excellent mechanical performance. However, lower yield strength of the alloy is the major issue needs to be tackled. It has been understood that twin formation becomes easier with lower stacking fault energy. An increase in Co-content in Ni-Co based alloys reduces the SFE. Thus, in Co-Cr-Ni alloy system the SFE can be reduced by tailoring the elemental composition. However, till now no published reports are available on tailoring the CoCrNi alloy composition during LDED. The present study reports the microstructure and phase evolution in LDED-built Cox(CrNi)100-x (x=20 wt.%, 50 wt.%, 60 wt.% mentioned as Co20, Co50, Co60) alloy (Fig. 1(a)). The cellular and columnar substructure is observed along both the scan direction (SD) and build direction (BD) as shown in Fig.1(b). The formation of the substructure is attributed to the dynamic evolution of dislocations, Cottrell environment, and strain aging. The formation of cellular substructure is facilitated by grain boundaries. This suggests that the substructure evolution is occurring through solidification. It could be seen that the subgrain size is more refined along BD than SD of the respective sample. In addition, grain refinement is observed with the increase in Co-content (Co20→Co60). Besides, XRD peaks revealed the presence of the HCP of in Co50 and Co60 samples as seen in Fig. 1(c). The fraction of HCP phase is increased with the increase in Co-content. The presence of the HCP phase is also confirmed with the EBSD studies. As per previous similar studies on vacuum arc melted Cox(CrNi)100-x alloy system, it has been suggested that the presence of HCP phase strengthens the alloy. This study has good relevance with the additive manufacturing methods for material innovations and characterization of new combinations of materials.

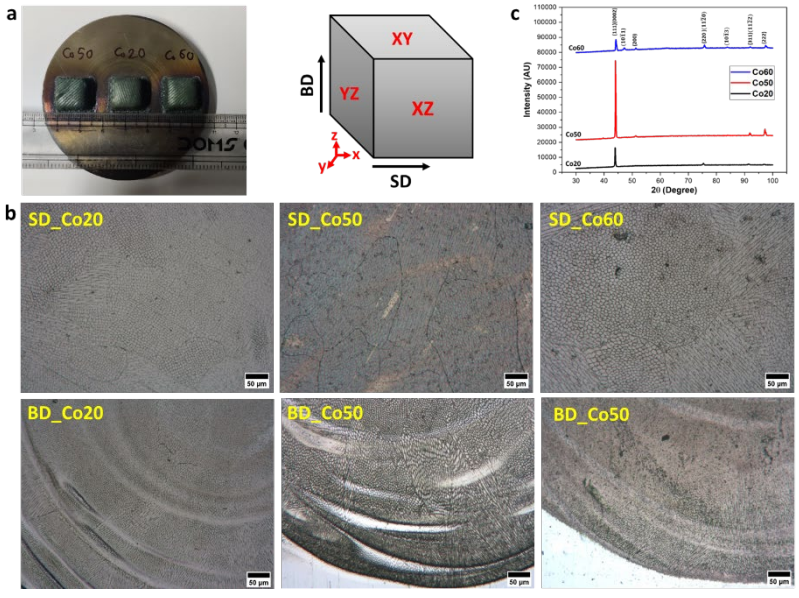


*Figure **1** – (a) LDEDed Co20, Co50, Co60; (b) Microstrcuture along SD and BD*; (c) XRD peaks of $Co_x(CrNi)_{100-x}$