A FORMABILITY OF TWO COPPER-BEARING, COLD ROLLED, BOX ANNEALED AND TEMPER ROLLED EXTRA-DEEP DRAWING LOW CARBON ALUMINIUM-KILLED STEEL SHEETS OF NAGARJUNA STEEL LIMITED (PRIVATE, ANDHRA), AND A COMPARISON WITH THAT OF A TYPICAL STEEL SHEETS MADE BY BOKARO STEEL PLANT (STEEL AUTHORITY OF INDIA LIMITED, MINISTRY OF STEEL, GOVERNMENT OF INDIA)

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ABSTRACT
This market-driven research publication is on the formability of two extra-deep drawing (EDD) steels in whose manufacture scrap addition is present and their chemistry may in turn show the presence of residual copper. It is known that the heat treatment response is significantly affected by the presence of copper. The present study was undertaken to evaluate the formability of two copper-bearing EDD steel sheets (0.07%Cu and 0.13%Cu). With the help of specially fabricated punch-die set up, stretching experiments were performed and in turn forming limit diagram (FLD) was plotted. Preliminary tests assess microstructural features, their behaviour in tension and formability parameters were also performed on both EDD sheets. It has been seen that both the 0.07%Cu and the 0.13%Cu EDD steel sheets displayed poor deep-drawability compared to 0.01%Cu EDD steel, mainly because of their low average plastic strain ratio ($\overline{\varepsilon}$). The lower $\overline{\varepsilon}$ value (and as a consequence the reduced deep-drawability, especially, in the extra-deep drawing region) observed in the 0.07%Cu and 0.13%Cu EDD steel sheets could be due to poor processing, eg., use of a higher heating rate and reduced annealing time. TEM studies revealed no evidence for Cu precipitation in both the 0.07%Cu and 0.13%Cu EDD steels. Intensities of {111} texture components are low and in turn these heats show low formability.

KEYWORDS: Formability, Forming Limit Diagram, Copper-Bearing Edd Steel, Extra-Deep Drawing, Strain Hardening Coefficient, Normal Anisotropy & Strain Distribution

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