

Table 11(b). Hall-Petch Values of Annealed and Temper Rolled Samples

S.NO	Annealed				T.Rolled			
	σ_o	K	σ_{calc}	σ_{exp}	σ_o	K	σ_{calc}	σ_{exp}
1	2.847	0.6741	-	-	305	-1.14	-	-
2								
3	-	-	98.145	105.45	-	-	134	143.5
4	1147	-7	-	-	151.06	0.038	-	-
5								
6	-	-	243	107.5	-	-	55.91	156.11
7	-167.69	1.813	-	-	149.579	0.047	-	-
8								
9	-	-	46	103.5	-	-	155.205	166.385

Conclusion

Cold rolling has a marked impact on mechanical properties. Variation in mechanical properties has been investigated for SAE 1006 interstitial free (IF) steel during the cold rolling process. The results have shown that pickling does not affect the mechanical properties. However, extensive plastic deformation, i.e., cold working, increases hardness, tensile stress, yield stress, and a decrease in ductility because the grain structure is distorted, dislocations are pile up at the grain boundary. This grain boundary causing hindrance for dislocation movement, a high amount of dislocation density is created and a significant amount of deformation energy is stored. Stress relief annealing results in coarsening and homogenizing of grains, reducing the high flow stresses of cold worked material and reducing high dislocation density created, thus impart ductility in the sheet. An increase in yield and tensile strength is observed at the fourth stage of cold rolling; temper rolling. A minimal reduction of about 0.5% – 2% of total thickness is performed to harden the surface; a minimal grain size reduction is observed. A small number of dislocations are created than in the second stage of cold working, i.e., 4-Hi cold rolling mill. This causes an increment in mechanical parameters again, improves surface hardness and flatness.

Also, ISL samples were compared with HESCO samples. Results have shown that HESCO has a smaller grain size, better strength, stiffness and other mechanical properties than ISL samples. It is revealed that there are still some elongated grains found along with coarse grains after annealing in ISL samples. Soaking time is not sufficient for the growth of homogenized structure, which results in a decrease in ductility and formability during deep drawing.

Regarding the fact that the client's demands on the resulting mechanical properties can vary a lot, it is impossible to establish a general heat treatment cycle that would be the best suitable to fulfill customer demands. ISL can also attain better

quality and mechanical properties of its products by increasing soaking and cooling time during annealing.

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