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Study the effect of micro alloy 30MnSiVS6 material control cooling during forging: A Case Study

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Abstracts: **The aim of this paper is to study the effect of hot forging temperature at various stages of micro alloy Steel 30MnSiVS6,numbers of trials conducted in forging industry to understand the combine effect of Temp, Control cooling arrangements (Fast cooling , Slow cooling) & effect of chemistry on hardness and tensile, by end of this trials we know the Chemistry of Steel raw material play vital role to increase and decrease of hardness or tensile i.e mechanical property control cooling effect is not much important**.

Keywords: **Hot Forging, Control Cooling, Micro alloy, Hardness & Tensile.**

1. INTRODUCTION

The aim of the present work was to interpret the effect of process variable & chemical property on phase transformation and mechanical property. In recent years, micro alloyed (MA) medium carbon steel have gained acceptance as a replacement for a quenched and tempered grade (Q-T) in automotive and some other applications. The driving force to use MA steel is cost reduction due to elimination of post forging heat treatment, straightening and stress relieving and improved machinability [1,2].

In this paper, the development and choice of steel for radial housing application are used to illustrate the stages in the process of the selecting raw materials for new applications. The goal of this study to optimize selection of the appropriate micro alloyed bar steel that simultaneously satisfies strength requirements to meet the criteria in specific area listed below for high performance as well as archives the required properties , i.e hot formability and machinability , required to successfully and economically produce the parts.

In present work, the influence of hot forging parameters on the microstructure and mechanical properties of 30MnSiVS6 has been investigated.

Although Micro alloyed steels have the same level of strength in comparison with quenched and Tampered steels, their toughness is lower. To improve toughness carbon content of micro alloyed steel has been reduced over the years, and decrease in strength as a consequences of this is compensated by micro alloying with Vanadium, using its precipitation hardening effect.[3]

Further increased of toughness can be achieved by microstructure control during the thermomechanical processing. [4]

2. METHODOLOGY

2.1 The material used in this study was the commercial grade micro alloy steel 30MnSiVS6 the chemical composition of this steel shown in the table1.

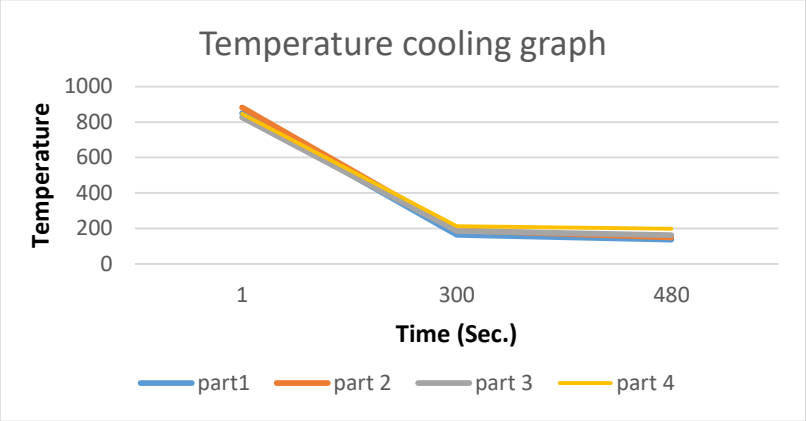
Summarizes the compositions of the chosen steel for this study. T1 steel are forged and Studies the effect in mechanical property with rate of cooling for this study 30 mm steel bar forged at 1150-1260^{0}C.

Chemical composition of the steels for Radial housing.

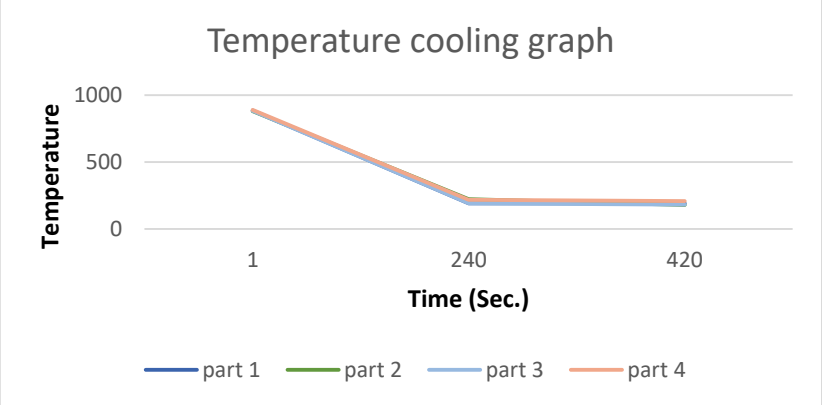
Steel	C	Si	Mn	S	Cr	Mo	V
T1	0.29	0.52	1.27	0.046	0.12	0.006	0.085

Table 1

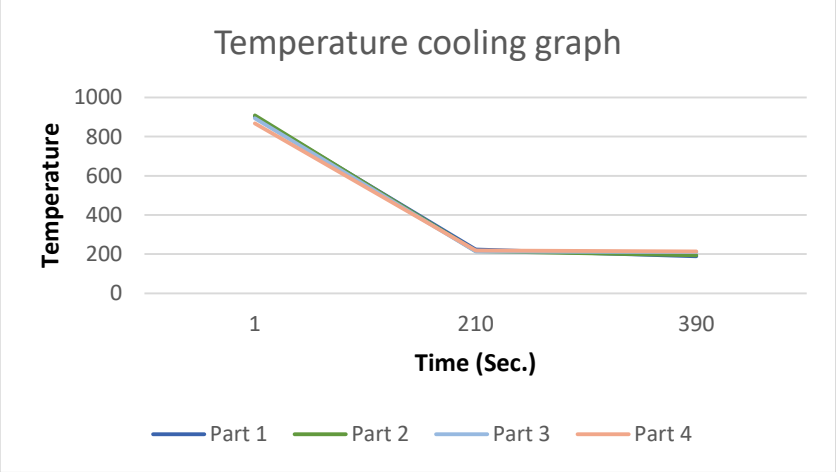
Part No Sequence	Billet Temp	Temp at Trimming	Temp at Exit of conveyor	Total time in conveyor (Sec)	Hardness BHN	Conveyor Speed (HZ)	Cooling Rate
1	1239	850	137	480	229	0.3	1.49
2	1248	882	150	480	229	0.3	1.53
3	1226	827	162	480	229	0.3	1.39
4	1247	866	198	480	226	0.3	1.80
5	1236	846	137	480	226	0.3	1.35
6	1236	834	173	480	229	0.3	1.45
7	1245	851	192	480	226	0.3	1.41
8	1250	859	182	480	229	0.3	1.39
9	1239	899	190	420	229	0.6	1.65
10	1255	885	180	420	226	0.6	1.65
11	1248	881	181	420	229	0.6	1.67
12	1244	882	207	420	229	0.6	1.67
13	1255	889	211	420	229	0.6	1.62
14	1256	907	196	420	229	0.6	1.66
15	1242	884	209	420	229	0.6	1.64
16	1250	906	201	420	229	0.6	1.66
17	1236	902	189	390	235	0.9	1.83
18	1238	908	194	390	235	0.9	1.83
19	1260	894	210	390	229	0.9	1.75
20	1244	868	214	390	229	0.9	1.68
21	1245	859	197	390	235	0.9	1.70
22	1236	868	187	390	235	0.9	1.75
23	1246	911	231	390	235	0.9	1.74
24	1244	908	245	390	235	0.9	1.70



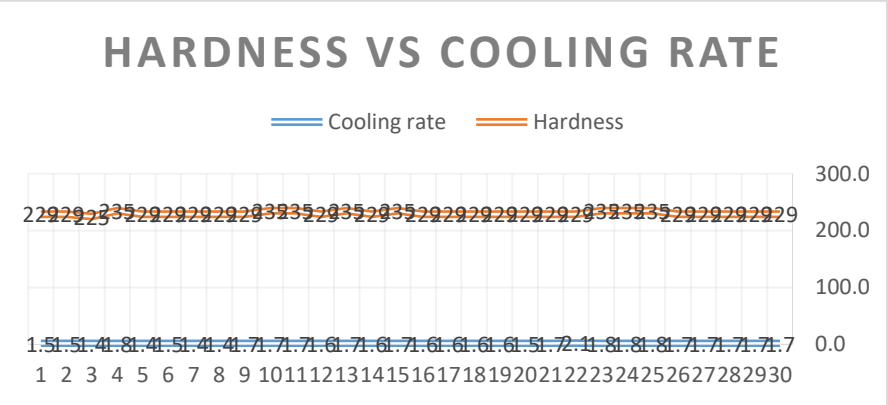
Trial 1 (Graph -1)



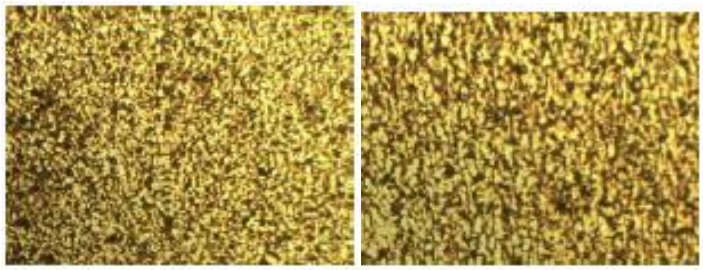
Trial 2 (Graph-2)



Trial 3 (Graph -3)



Graph - 4



Micro-1 **Micro-2**

Etchant: 3% Nital & Mag: 100X

Pearlite & Grain Boundary Ferrite Structure.

3. CONCLUSION

We investigate the property of a number of specimens that were subjected to various thermomechanical treatment at 1150- 1260^{0}C followed by forced air cooling at the rate of 1.49 -1.83 ^{0}C/sec at various conveyor RPM , the surface hardness value increase very incremental. Chemistry of material play vital role in increasing the hardness or decreasing the hardness value in micro alloy steel. By adjusting the control cooling Parameters such as frequency cooling time increase or decrease we can get a only a certain amount of hike or downfall in hardness major change can be only done by revising the chemistry.

By increasing or decreasing (C, V, Mn, Mo) hardness can be increased or decreased (Core and surface hardness).

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