

USING DÖRRENBERG'S STEEL IN MACHINE INDUSTRY

Conf. dr.ing. Aurel CIUREA
Universitatea "Dunarea de Jos" din
Galati

ABSTRACT

The steels were, are and will be o long period of time the raw material in machine industry. Using of this materials implicate a very good technical performance for each type and theirs compatibility with the working environment. This study propose a analyze on application possibilities of using Dörrenberg steels.

1 Brands of steel and using domains

The complexities of products which are fabricated in machine industry impose the use of a large scale of steels for both the raw material and the necessary tools for the processes.

The chose of a material is, always, a complex process, who necessity a solid analyzes of the next sides:

- mechanical characteristics;
- chemical composition;
- exploitation restriction;
- economic efficiency;

Will analyze five groups of steels, made by Dörrenberg Edelstahl, corresponding for five utilization domains.

a) Steels for hot metal working tools.

Used for hot metal working tools, the most important characteristic is their hardness. In the next diagrams will show the possible achieve hardness for each steels listed above, according to the reversion temperature.

Due to the characteristic who the steels can obtain, they can be utilized for the execution of the next markers:

- matrices for plastic masses;
- puncher tools;
- tools for cold extrusion;
- cutting tools used for higher effort;
- hollow tools;
- matrices for plastic hot deformation.

Table no 1: chemical composition.

Name according to		Chemical composition [%]							
DIN	Dörrenberg brand	C	Si	Mn	Cr	Mo	V	Ni	W
1.2767	VNC 4	0,45	0,25	0,30	1,40	0,20	-	4,00	-
1.2550	Hidalgo I	0,60	0,70	0,30	1,00	-	0,20	-	2,00
1.2842	Z 1 B	0,90	0,30	2,00	0,40	-	0,15	-	-
1.2510	Z 3 C	0,95	0,25	1,10	0,60	-	0,10	-	0,60
1.2379	CPPU	1,55	0,25	0,30	12,00	0,80	1,00	-	-
1.2080	CP 10 V	2,00	0,25	0,30	12,00	-	-	-	-

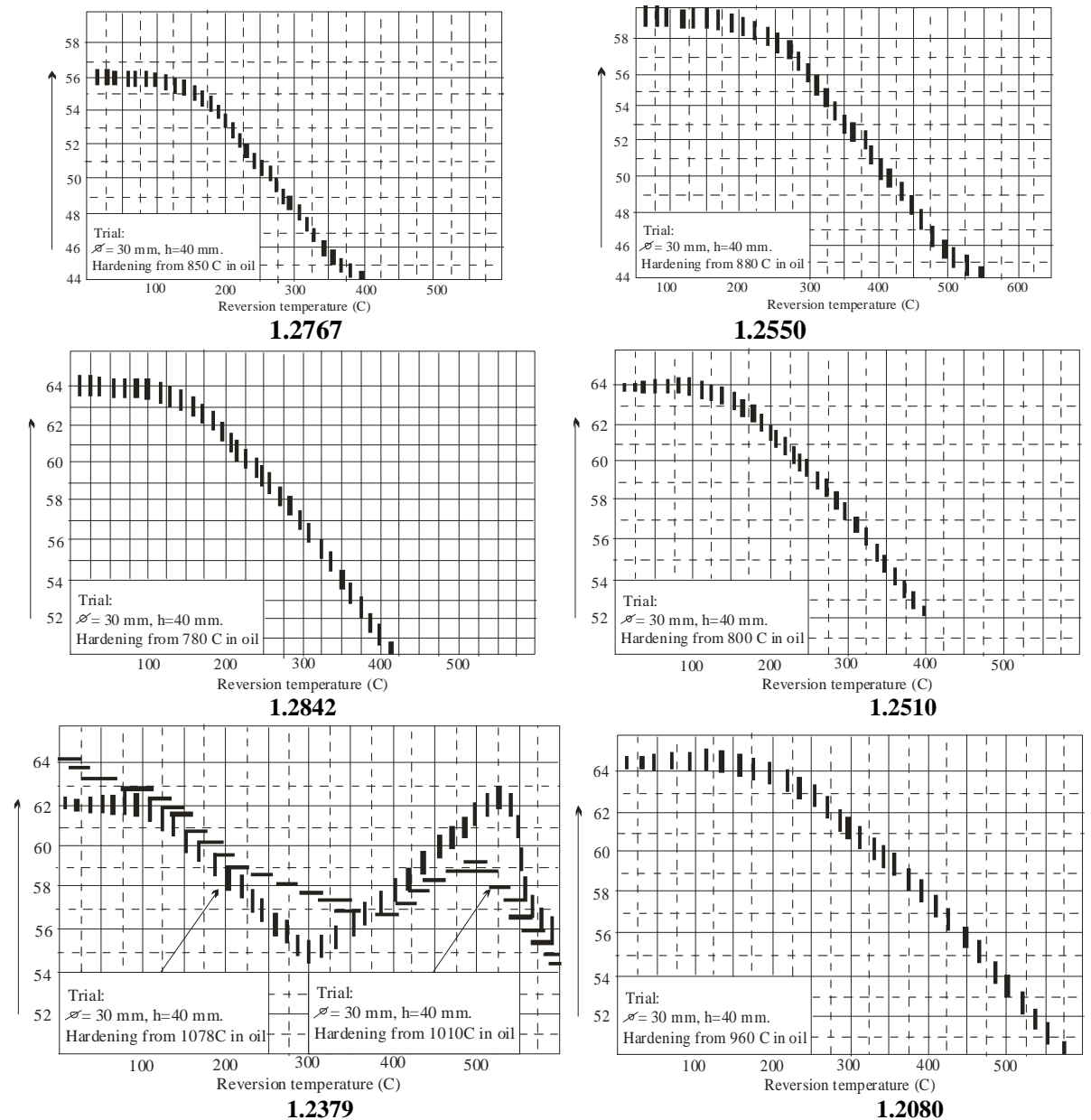


Figure 1: Variation of the hardness with the reversion temperature for steels for hot metal working tools.

These steels, at temperatures between 400 and 500 °C, have the hardness over 40 HRC, which, in case of utilization for matrices for plastic hot deformation don't create the risk of decreasing the hardness due to the worming of the tools in time of deformation. The exterior hardness

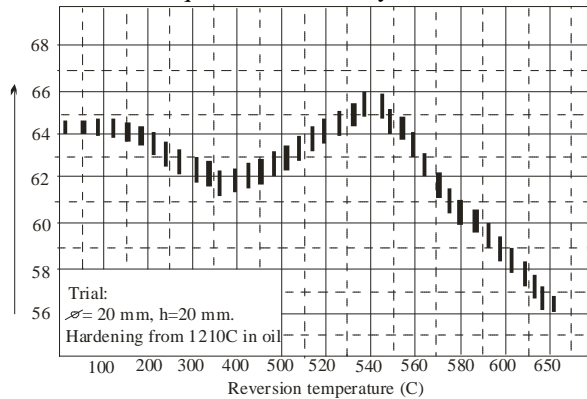
fluctuates between 58 and 64 HRC, which give good tear strength.

b) Quick steels

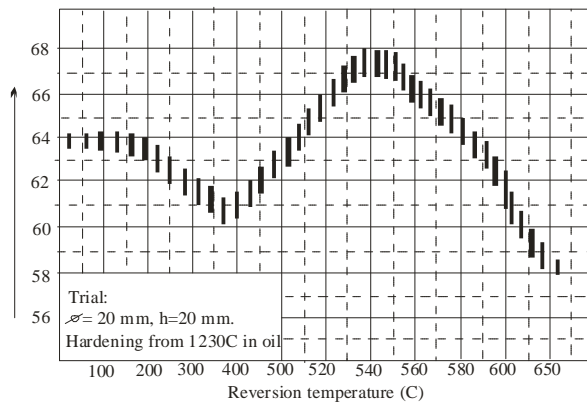
Table no 2: chemical composition

Name according to		Chemical composition [%]								
DIM	Därenberg brand	C	Sb	Mn	Cr	Mo	V	Ni	W	Co
1.3343	DMO5	0,90	<0,45	<0,40	4,00	5,00	1,90	-	6,40	-
1.3243	EMO5CO5	0,92	<0,45	<0,40	4,00	5,00	1,90	-	6,40	4,80
1.3207	EMO12	1,28	<0,45	<0,40	4,00	3,50	3,30	-	9,50	10,0

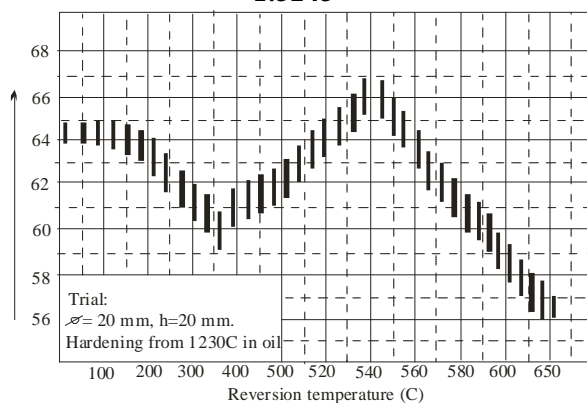
Although that the materials used for cutting of metals tools, knew, today, a very large diversity, the quick steels kept their place the palette solicited by the specialists. The tenacity, the possibility of reconditioning the tools, the high hardness (60-66 HRC), and the fact that they keep their hardness in conditions of warming during cutting of metals process till 500-550 °C, prescribe them for cold work tools. In diagram no 2 is give the variation of the hardness with the reversion temperature for the three kinds of quick steels analyzed.



1.3343



1.3243



1.3207

Figure 2: variation of the hardness with the reversion temperature for the quick steels

We see the fact that the three kinds of quick steels have higher hardness (66 to 68 HRC) which confers to the tools a very good attitude in exploitation.

c) Steels for thermal-improvement treatment

The recommended thermal treatment condition is:

- a) for soaking:
- 4340 à 650-700 °C, cooling in furnace, maximum hardness: 248 HB;
 - M4S à 680-720 °C, cooling in furnace, maximum hardness: 241 HB;

After the soaking of steels, they have a good behavior at cutting of metals treatment

- b) for improvement:
- 4340 à hardening at 830-860 °C / oil, return 540-680 °C;
 - M4S à hardening at 820-850 °C / water, 830-860 °C / oil, return 540-680 °C.

The mechanical characteristics shown in table no 4 prescribe the two kinds of steel for the execution of higher degree saturation markers like:

- axes;
- indented wheels;
- pinions;

d) Cemented steels

The exemplary working hardness in cemented-hardened state: 58-62 HRC.

The working through cutting potential is very good seeing the maximum hardness: 229 HB for MN17 and 207 HB for MN16.

The possibility of carburetion recommended them for the execution of tear requested markers but which request a good mechanical strength in the pulp.

e) Nitriding steels

The hardness in annealed state is maximum 248 HB, which offer a very good cutting workability.

The mechanical characteristics offer a good mechanical strength, and the hardness obtained after nitriding, good tear strength.

Table no 3: chemical composition

Name according to		Chemical composition [%]					
DIM	Därrenberg brand	C	Si	Mn	Cr	Mo	Ni
1.6582	4340	0,34	<0,40	0,60	1,60	0,25	1,60
1.7225	M4S	0,42	<0,40	0,60	1,10	0,20	

Table no 4: Mechanical properties in hardened-tempered treatment

Därrenberg brand	Diameter [mm]	Mechanical strength [N/mm ²]
4340	< 16	1200 – 1400
	> 16 - 40	1100 – 1300
	> 40 – 100	1000 – 1200
	> 100 – 160	900 – 1100
	> 160 – 250	800 – 950
M4S	< 16	1100 – 1300
	> 16 – 40	1000 – 1200
	> 40 – 100	900 – 1100
	> 100 – 160	800 – 950
	> 160 – 250	750 - 900

Table no 5: chemical composition

Brand according to		Chemical composition [%]					
DIN	Därrenberg	C	Si	Mn	Cr	Mo	V
1.6587	Mn 17	0,17	< 0,40	0,50	1,70	0,30	1,60
1.7131	MN 16	0,16	< 0,40	1,20	1,00	-	-

Table no 6: Mechanical properties in hardened-tempered treatment

Därrenberg brand	Diameter [mm]	Mechanical strength [N/mm ²]
MN 17	11	1150 – 1450
	30	1050 – 1350
	63	950 – 1250
MN 16	11	900 – 1200
	30	800 – 1100
	63	650 - 950

Table no 7: chemical composition

Brand according to		Chemical composition [%]							
DIN	Därrenberg	C	Si	Mn	Cr	Mo	V	Ni	Al
1.8519	Ni 19	0,31	< 0,40	0,60	2,50	0,20	0,15	-	-
1.8550	Ni 50	0,34	< 0,40	0,60	1,70	0,20	-	1,00	1,00

Table no 8: Mechanical properties in hardened-tempered treatment

Därrenberg brand	Diameter [mm]	Mechanical strength [N/mm ²]	Hardness after nitrification
Ni 19	< 100	1000 - 1200	~ 850 HV1
	> 100 < 250	900 – 1100	
Ni 50	< 100	850 – 1050	~ 1000 HV1
	> 100 < 250	800 – 1000	

2. Conclusions

Steel manufacturers give attention to the adaptation of the elaborated kinds of steel to the punctual requirements. In this manner can be correctly mixed the demanded properties with economic efficiency generated by the chemical composition and the special elaboration measure. The analyzed kinds of

steel express relative small utilized domains and, for this reason, they can be efficiently elaborated.

References

- [1]. **Därrenberg Edelstahl** – *technical cards*;
- [2]. **Trusculescu, Marin** – “*The study of metals*” – Didactic and Education Publishing house, Bucharest, 1977.