SIHARD K770 Steel

Designation by standards

Brand Name	Ravne	Mat. No.	DIN	JIS	AISI/SAE
SIHARD K770	OCR12VML	~1.2379	~X153CrMoV12	SDK11	~D2

Chemical composition (in weight %)

C	Si	Mn	Cr	Mo	V	W	Others
1.47	0.25	0.45	12.00	0.90	0.30	-	-

Description
SIHARD K770 is a ledeburitic, high chromium cold work tool steel with high and very good combination of wear resistance and toughness. The SIHARD K770 steel excels itself through the following properties: A very good combination of wear resistance and toughness, high hardness, nitridability and high dimensional stability.

Applications
Typical applications for SIHARD K770 cold-work tool steel: Blanking dies, thread roll dies, punches, coining dies, drawing dies, upsetting dies, cutting tools, cutting rolls and cutting knives.

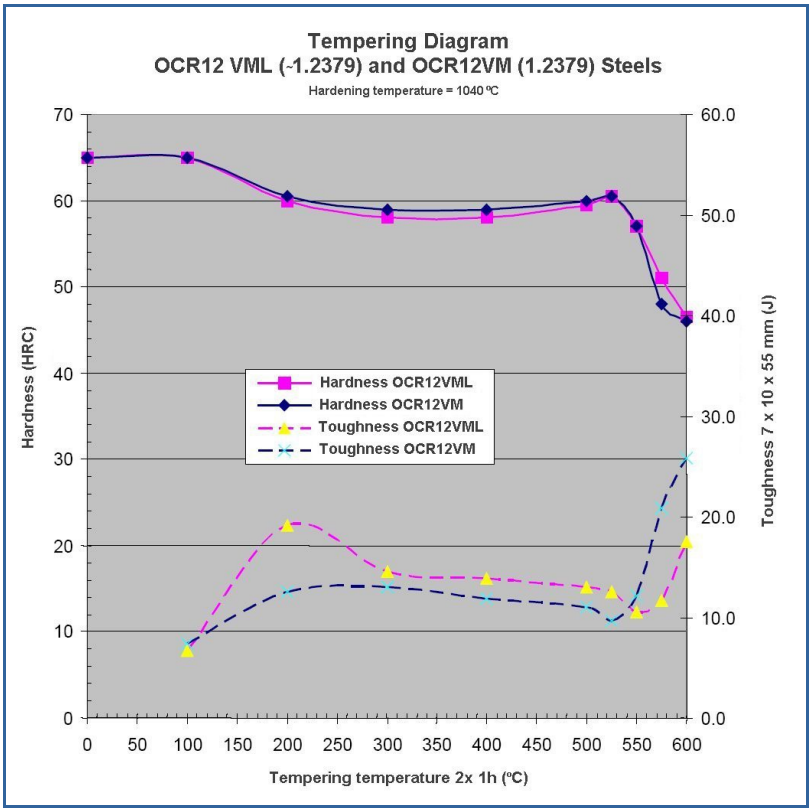
Comparison to SIHARD 2379 (D2)

Comparison of chemical compositions (wt.%)

Steel	Standard	C	Si	Mn	P	S	Cr	Mo	V
OCR12VM	EN ISO 4957	1.45 1.60	0.10 0.60	0.20 0.60	max. 0.030	max. 0.030	11.0 13.0	0.70 1.00	0.70 1.00
OCR12VM	BS 4659	1.40 1.60	max. 0.60	max. 0.60	max. 0.030	max. 0.035	11.5 12.5	0.70 1.00	0.25 1.00
OCR12VML	Ravne	1.43 1.50	0.15 0.35	0.30 0.60	max. 0.025	max. 0.010	11.0 13.0	0.80 1.20	0.28 0.33

Click the table to enlarge the data.

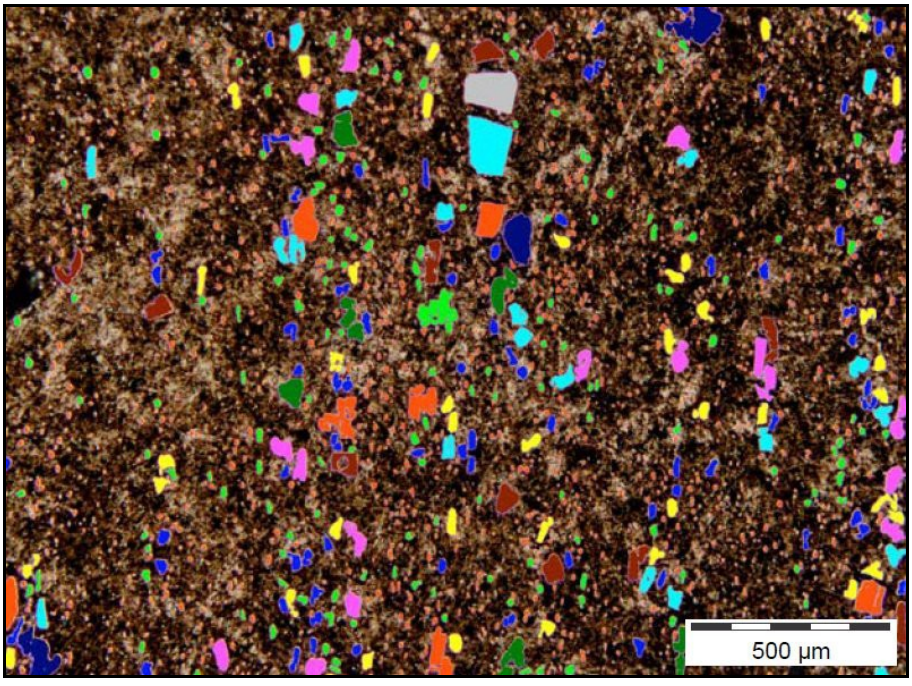
Comparison of tempering diagrams



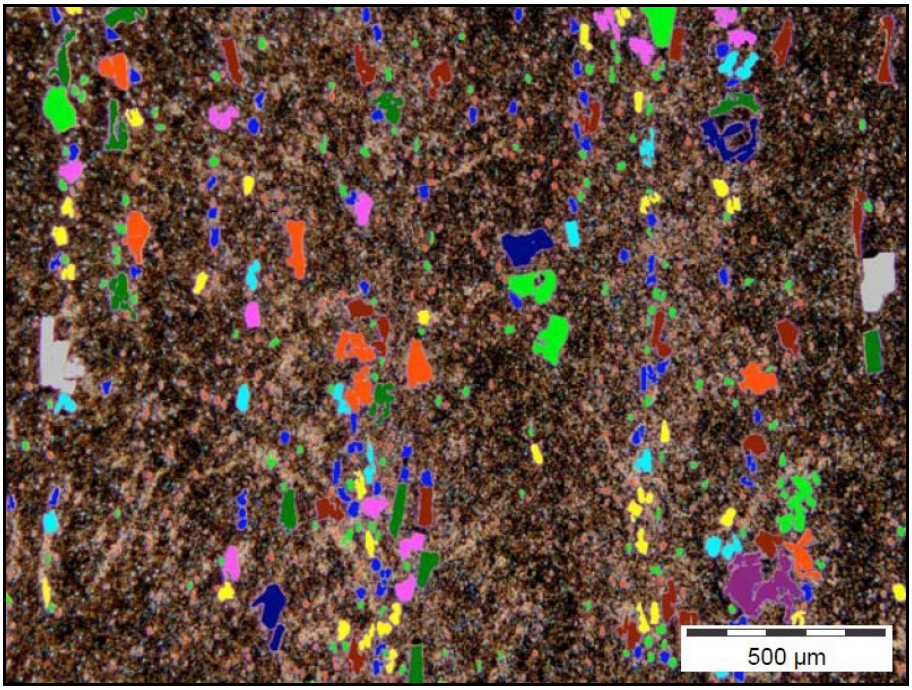
Click the image to enlarge the diagram.

Both steels have the same hardness after quenching and quenching, and SIHARD K770 steel have slightly higher toughness at a tempering temperature of about 200 ^{O}C.

Comparison of microstructures

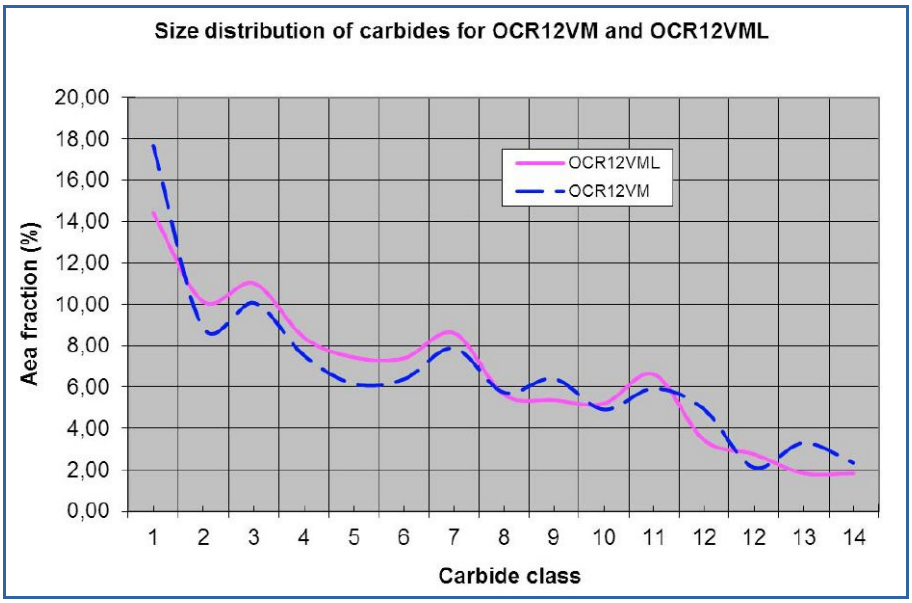


Microstructure of SIHARD K770 steel. Martensite, ledeburite and secondary carbides. ASTM E112 grain size: 8.



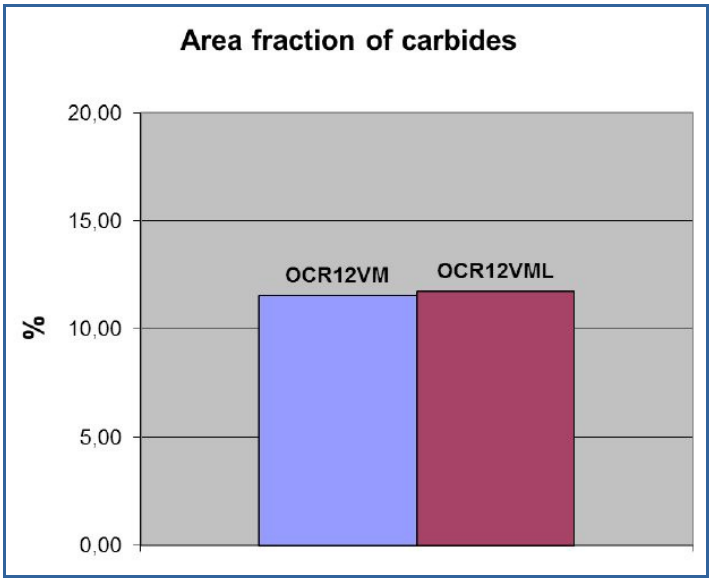
Microstructure of SIHARD 2379 steel. Martensite, ledeburite and secondary carbides. ASTM E112 grain size: 8.

Size distribution of carbides



Click the image to enlarge the diagram.

Comparison of a carbide fraction



Click the image to enlarge the diagram.

Comparison of properties

	OCR12VML	OCR12VM
Wear resistance	8	8
Toughness	3	2
Hot hardness	6	6
Working hardness	58 – 64 HRC	58 – 64 HRC
Hardenability	deep	deep
Workability	3	3

Click the table to enlarge the data.

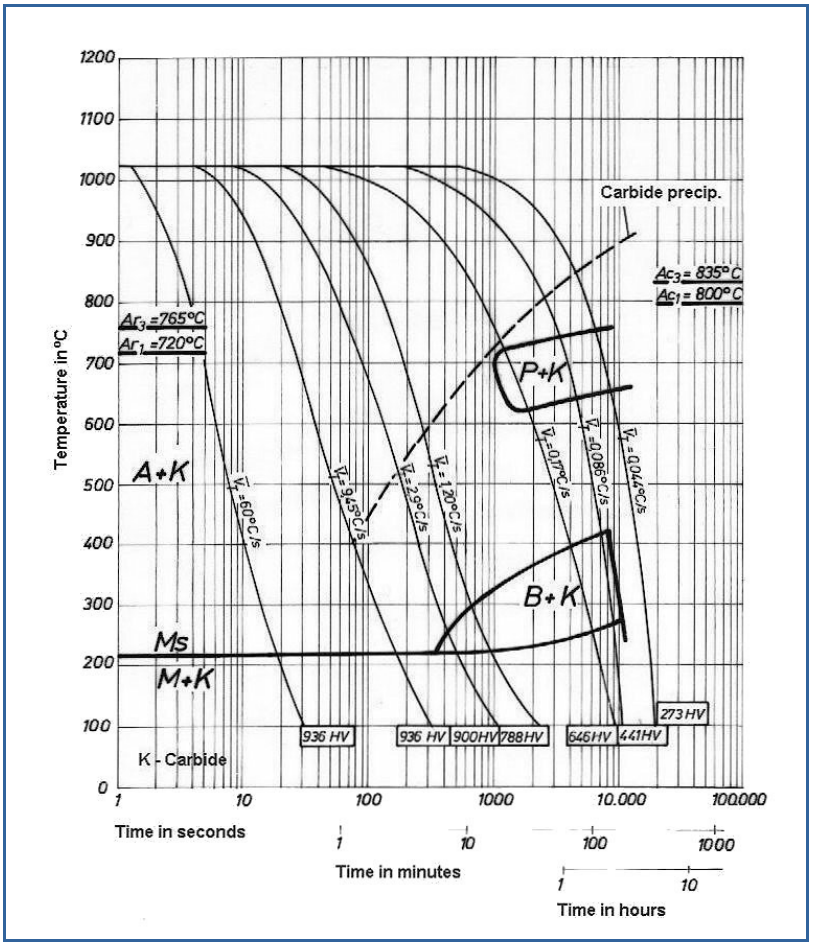
Physical properties (average values) at ambient temperature

Modulus of elasticity [10^3 x N/mm^2]: 210
Density [g/cm^3]: 7.69
Thermal conductivity [W/m.K]: 20.0
Specific heat capacity[J/g.K]: 0.46

Coefficient of linear thermal expansion 10^{-6} m/(mK)

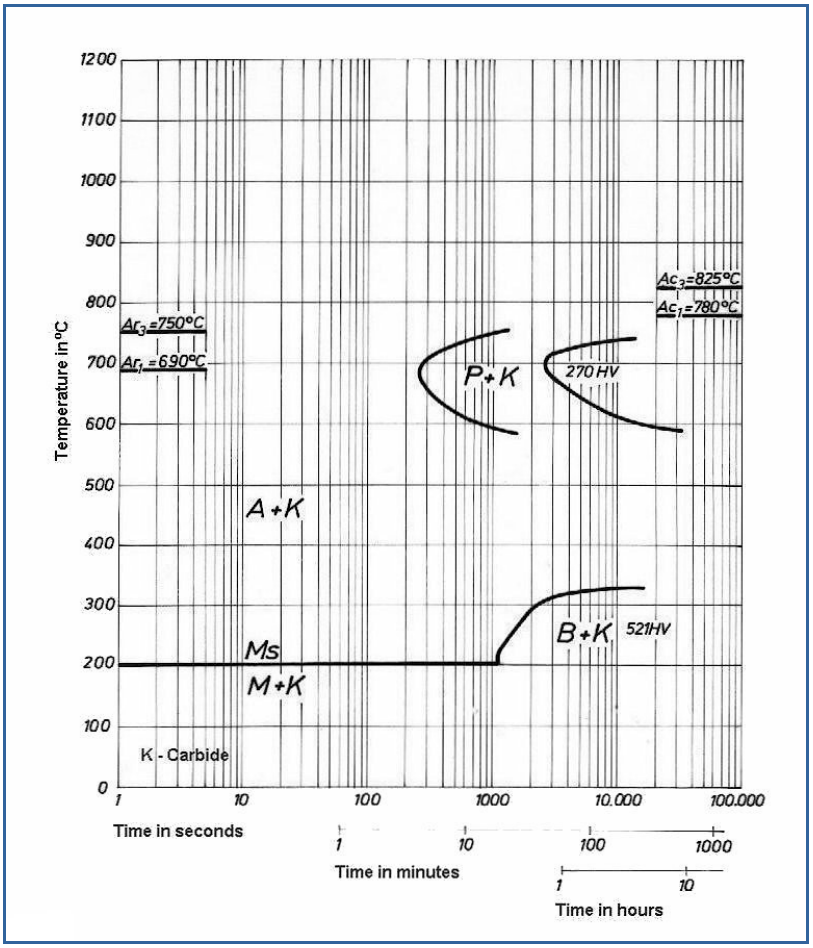
20-100 °C	20-200 °C	20-300 °C	20-400 °C	20-500 °C	20-600 °C	20-700 °C	20-800 °C
9.8	11.7	12.1	12.8	12.9	13.0	13.2	13.5

Continuous cooling transformation (CCT) diagram



Click the image to enlarge the diagram.

Time-temperature transformation (TTT) diagram



Click the image to enlarge the diagram.

Soft annealing

Heat to 840-880 ^{O}C, cool slowly in furnace. This will produce a maximum Brinell hardness of 250.

Stress relieving

Stress relieving to remove machining stresses should be carried out by heating to approx. 650-700 ^{O}C, holding for minimum 1 hour at heat, followed by air cooling in furnace. This operation is performed to reduce distortion during heat treatment.

Hardening

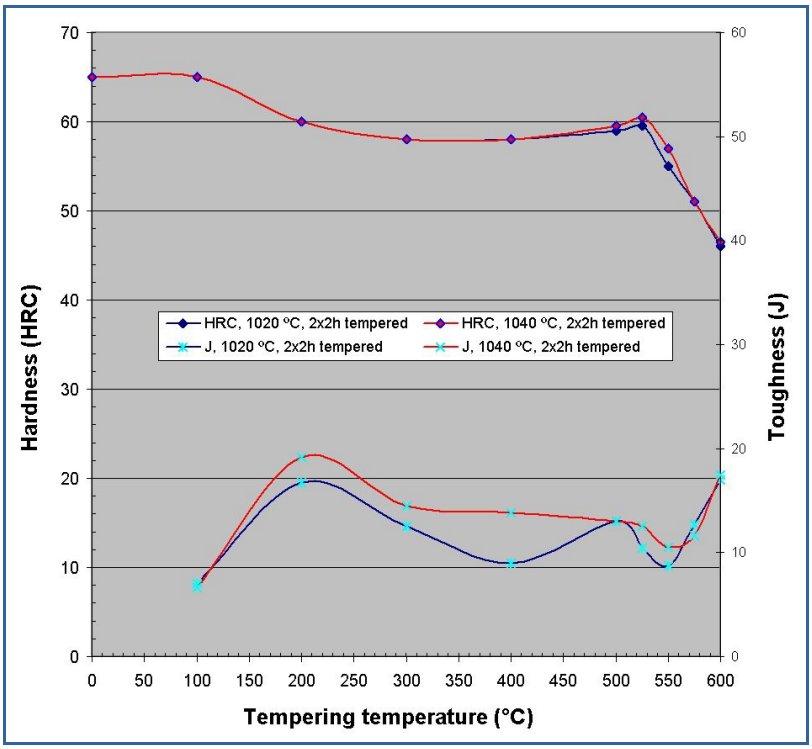
Harden from a temperature of 1020-1050 ^{O}C followed by oil, air quenching or warm bath quenching 500-550 ^{O}C. Hardness after quenching is 62-64 HRC.

Tempering

Tempering table

Temperature in ^{O}C	100	200	300	400	500	525	550	600	700
Hardness in HRC	63	61	58	58	59	59	57	46	35

Tempering diagram



Click the image to enlarge the diagram.

Forging

Hot forming temperature: 1050-850 ^{O}C.

Machinability

50-60% of a 1% carbon steel.

Surface treatments

To reduce friction and to increase wear resistance, surface treatment can be used. The recommended treatments are nitriding and surface coating with wear-resistant layers, for example via PVD.

Nitriding

Nitriding results in a hard surface layer which is highly resistant to wear and galling. The surface hardness after nitriding is approx. 1300 HV0.2.

PVD

Physical vapour deposition (PVD) is a method that applies wear-resistant coating at temperatures between 200 ^{O}C and 500 ^{O}C. PVD is a coating process for producing high-quality surface finishes. The coating produces an extremely hard surface, which is characterised by its resistance. It is particularly wear resistant. PVD TiN/(Ti,Al)N, CrN and TiN coatings have become important for several industrial applications at elevated temperature. It has been documented in the literature that TiN, CrN and TiN(Ti, Al)N PVD coatings can reduce friction in tribological contacts and increase the abrasive wear resistance.

Forms manufactured: Please see the Dimensional Sales Program.

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