SeAH CSS

SeAH Changwon
Integrated Special Steel

TOOL & MOLD STEEL

Contents

SeAH CSS's constant mission: Creating new value from steel for the world

Our constant mission is to open a door to the future of the global special steel industry.

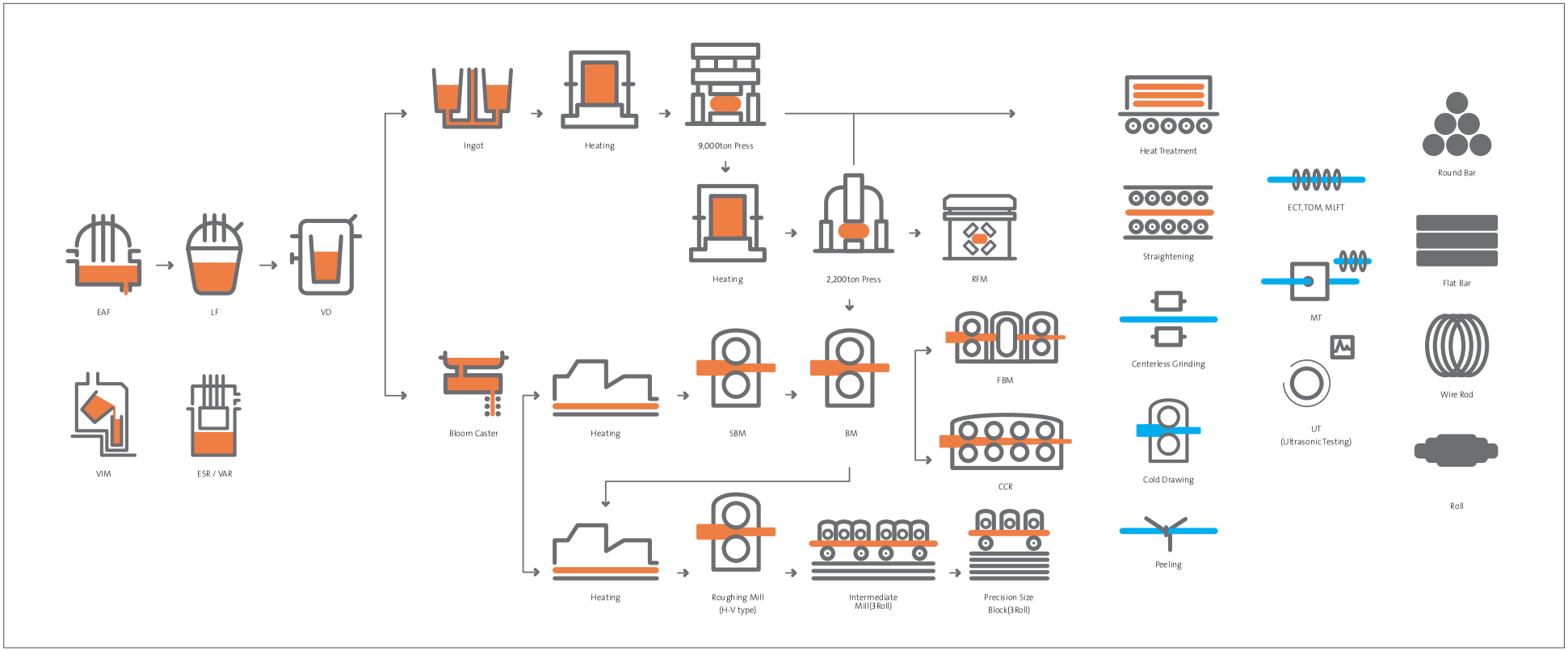
From high-tech industries including power generation, petrochemicals and semiconductors to futuristic industries such as nuclear power and aerospace, SeAH CSS is growing into a leader in Stainless steel, Tool steel, and Ni-alloys.

With our products, we aim to raise the level of customer satisfaction and set up the new industry standard by constantly challenging ourselves.

History

04/1966 Founded as Samyang Special Steel Co.,Ltd.
12/1977 Completed a general special steel plant as Korea Specialty Steel Co., Ltd
(for round bars, steel pipes and plates)
06/1982 Changed its name to SAMMI General Special Steel Co., Ltd
04/1991 Opened its second special steel plant
(for steelmaking, rolling, processing)
02/1997 Annexed to POSCO Group
(for round bars and pipe business)
10/2006 Completed the 1st phase of its facility rationalization
(AOD, HV Mill, Second acid cleaning plant and more)
02/2007 Renamed Changed its name to POSCO Specialty Steel Co., Ltd
04/2012 Completed the 2nd phase of its facility rationalization
(60ton EAF, Bloom Caster, SBM and more)
03/2015 Acquired by SeAH Group and changed its name to SeAH Changwon Integrated Special Steel Co., Ltd

Manufacturing Process



EAF

Ingot Casting

ESR

RFM

9,000ton Press

FBM

CCR

Furnace

Cold Work Tool Steel_STD11/SKD11[Equivalent to D2 (ASTM)& WNR1.2379 (DIN)]

H-Carbon and H-Chrome Steel provide extra hardness, excellent wear resistance and low dimensional change.

Product Characteristics

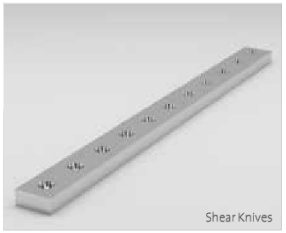
High Cleanliness	Exceptional wear resistance	Uniform Microstructure	Uniform hardness	Extra hardness

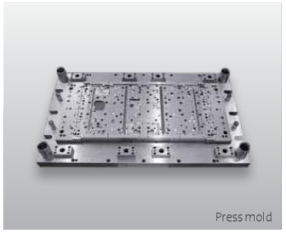
Chemical Composition

Grade	Chemical composition rate (Wt, %)							
	C	Si	Mn	P	S	Cr	Mo	V
SKD11	1.40 1.60	0.40	0.60	0.03	0.03	11.0 13.0	0.80 1.20	0.20 0.50

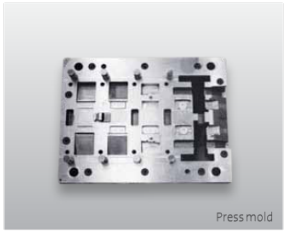
Applications

Applied to tool materials manufactured in a cold state.


Shear Knives

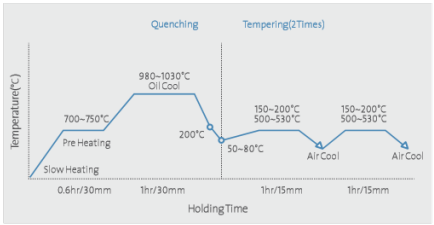

Press mold


Press mold


Press mold

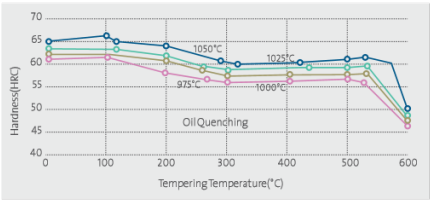
Heat Treatment Conditions

Quenching and Tempering Heat Treatment Cycle



Distribution of Heat Treatment Hardness

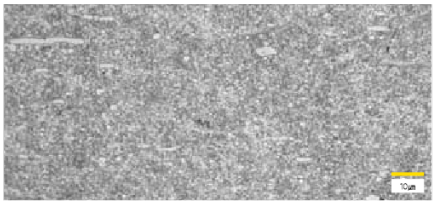
Quenching hardness: HRC 61 ~ 65 /2nd hardening occurs in the range of 400~530℃.



Microstructures

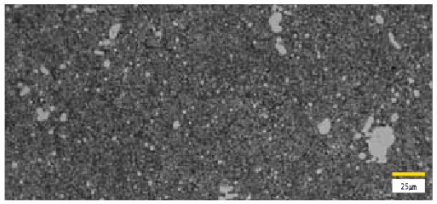
Spheroidizing Annealing

Spherical cementites and eutectic carbides in ferrite matrix

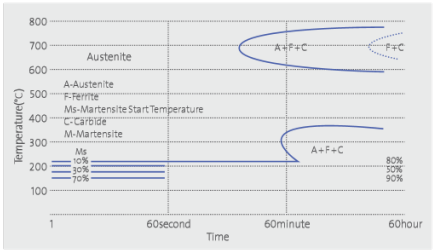


Quenching & Tempering

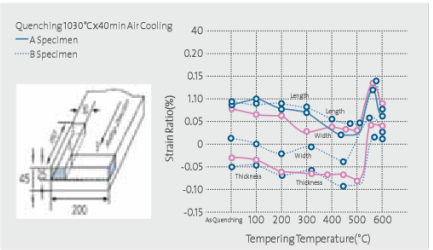
Tempered martensites and carbides



TTT Curve



Dimensional Change after Heat Treatment



Cold Work Tool Steel for High Tension Steel Plate Processing_TD1

Special elements are added for high tension steel plate processing. It provides extra hardness and wear resistance through Q/T heat treatment.

Chemical Composition

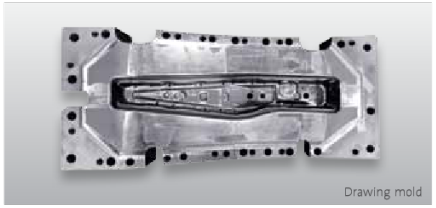
Grade	Chemical composition (Wt, %)								
	C	Si	Mn	P	S	Cr	Mo	V	Others
SKD11	1.40 1.60	0.40	0.60	0.03	0.03	11.0 13.0	0.80 1.20	0.20 0.50	-
TD1(aim)	1.0	1.0	0.6			8.0	1.3	0.2	Add.

Physical Properties

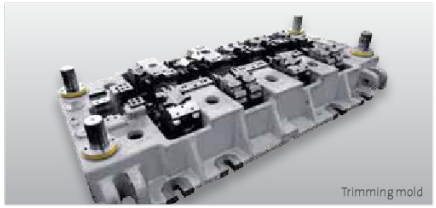
Thermal expansion co-efficient(X 10^{-6}/℃)	Specific gravity (g/cm³)	Heat conductivity (W/m·K)	Elastic co-efficient
11.6(27~100℃) 12.7(100~200℃)	7.65	26.7	220

Applications

Molds for manufacturing materials in cold state (Drawing / trimming mold for high tension steel plate).



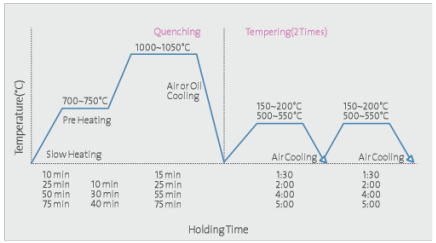
Drawing mold



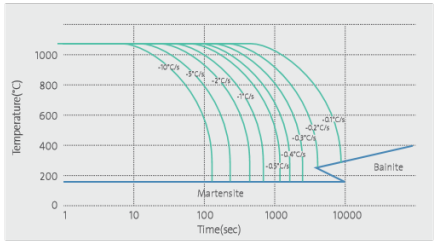
Trimming mold

QT heat treatment cycle

The same heat treatment applied to SKD11 available.

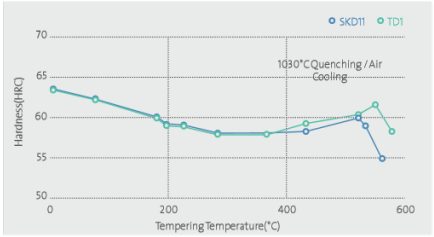


CCT Curve



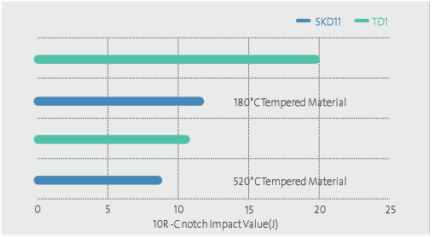
Hardness Curves

Enhances its hardness with below 600°C tempering condition.



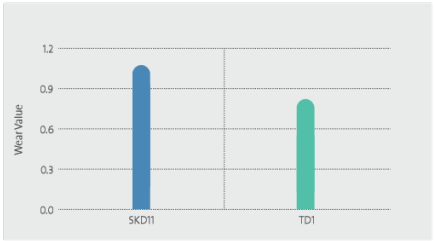
Impact Toughness

- Enhances its impact toughness by reducing carbide extrusion.



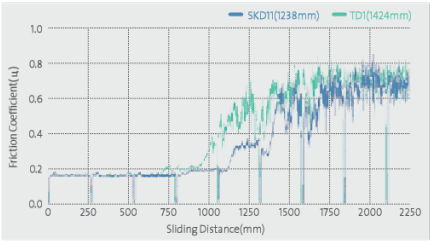
Wear Resistance

Enhances its wear resistance performance by adding special alloy.



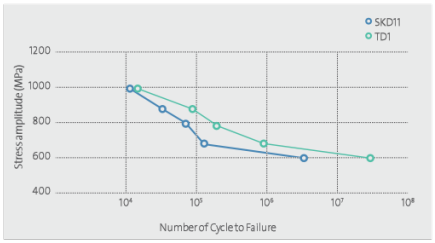
Galling Resistance

Enhances its durability by restraining scratch on mold surface and galling.



Fatigue Strength

Keeps the product durable by enhancing its fatigue strength.



Applications

A test result provided by one of vehicle component manufacturers.

Applicable molds	SKD11 durability enhancement rate	Work material
Center Pillar Outer	135%	DP980 1.6t
Steel Wheel	165%	HR580/ 330Y-DP
Door Hinge	110%	HR340LA, 4.0t

Hot Work Tool Steel_ STD61/SKD61[Equivalent to H13 (ASTM), WNR1.2344 (DIN)]

Tools with extra red hardness and heat crack resistance, used for die casting and extrusion molds.

Product Characteristics

Exceptional toughness and red hardness	Heat crack and wear resistance	Anti-heat treatment transformation	Suitable for hot die casting molds with its high Vanadium content	Suitable for Aluminum and Magnesium Pressing Dies

Chemical Composition

Grade	Chemical composition (Wt, %)							
	C	Si	Mn	P	S	Cr	Mo	V
SKD61	0.35 0.42	0.80 1.20	0.25 0.50	0.03	0.02	4.80 5.50	1.00 1.50	0.80 1.15

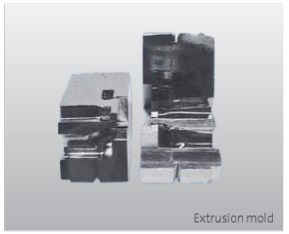
Physical Properties

Thermal expansion co-efficient (X 10^{-6}/℃)	Specific gravity (g/cm^3)	Heat conductivity (W/m·K)	Young's modulus (GPa)
12.5(25~200℃)	7.8	24(20℃)	205

Applications

Molds for manufacturing materials in a hot state.


Extrusion mold

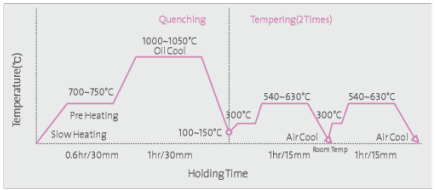

Extrusion mold


Die-casting mold

Heat Treatment Conditions

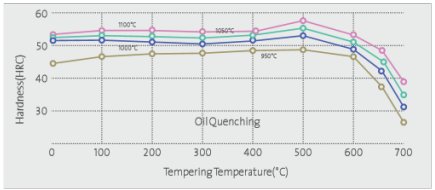
Quenching and Tempering Heat Treatment Cycle

A tempering temperature is set higher (+25 to 50°C) than the operative temperature.



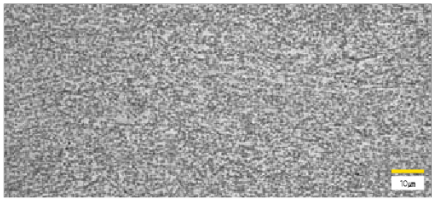
Distribution of Heat Treatment Hardness

When the temperature of a solid solution rises, its hardness increases as well. The 2ndhardening occurs in the range from 400 to 530°C



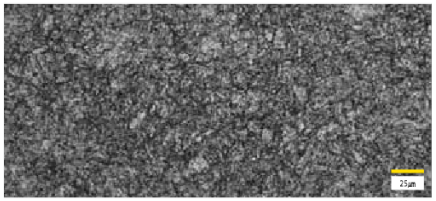
Microstructures

Spheroidizing Annealing



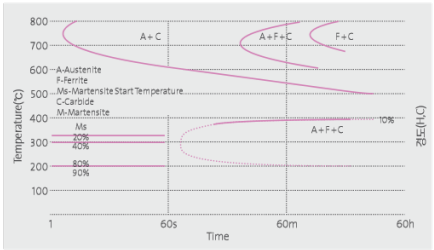
Spherical cementites in ferrite matrix

Quenching & Tempering

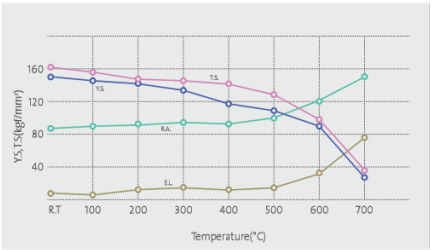


Tempered martensites

TTT Curve



High Temperature Material Properties



Hot Work Tool Steel for Die Casting_ DC1

Durable tool steels with added special elements help enhance productivity. They can be applied to large molds as well.

Chemical Composition

Grade	Chemical composition (Wt, %)								
	C	Si	Mn	P	S	Cr	Mo	V	Others
SKD61	0.35 0.42	0.80 1.20	0.25 0.50	0.03	0.02	4.80 5.50	1.00 1.50	0.80 1.15	-
DC1(aim)	0.4	0.6	0.6			5.0	1.3	0.7	Add.

Physical Properties

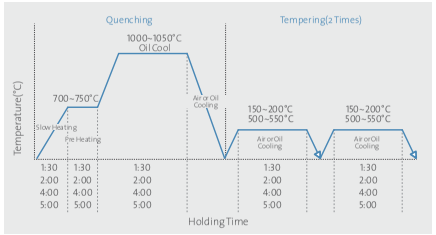
Temperature	Thermal expansion co-efficient (X 10^{-6}/℃)	Heat conductivity (W/m·K)
25℃	11.5	30.7
700℃	14.1	29.1

Applications

Hot tool steels for large scale die casting with extra toughness.

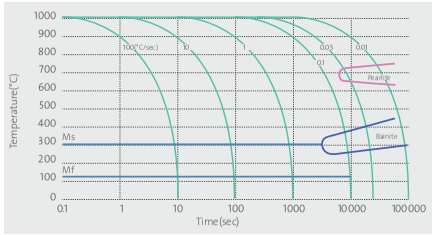
Heat Treatment Conditions

The same heat treatment applied to SKD61 available.



CCT Curve

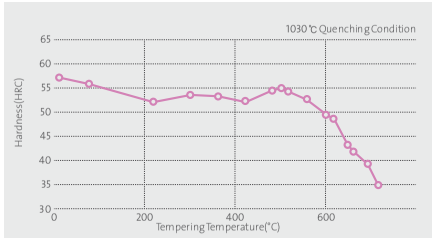
Quenching Temperature : 1030℃



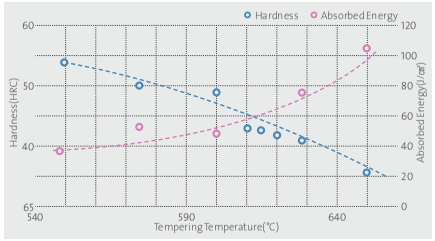
Mechanical Properties

- Extra hardness guaranteed during heat treatment.
- Excellent balance between hardness and impact toughness

Hardness Curve(HRC)

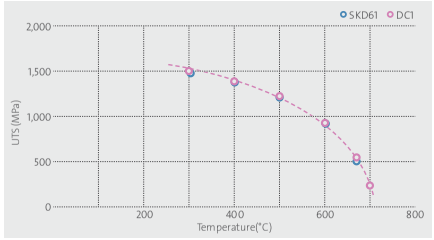


Impact Toughness



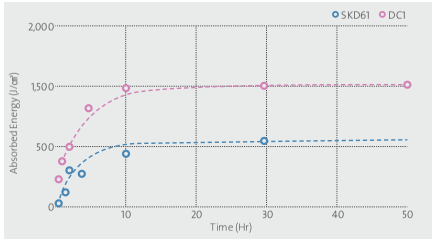
High Temperature Strength

- Enhances RA(Reduction of Area) rate.



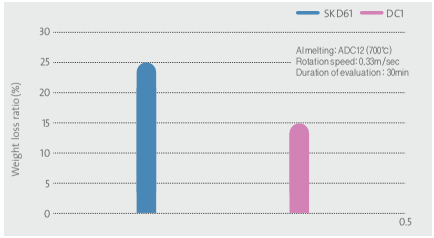
Temper Softening Resistance (Exposed to a temperature of 650℃)

-Enhances impact toughness and temper softening resistance through grain refinement at 650℃ (die casting Al molten metal requirement).



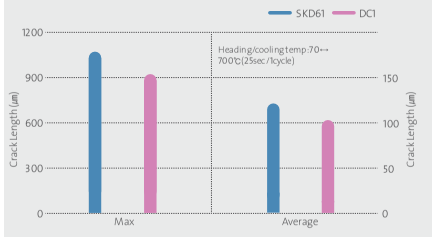
Erosion Properties

- Enhances anti-erosion Properties by optimizing alloying elements with Al molten metal.



Heat Crack Properties

- Reduces cracks through thermal stress.



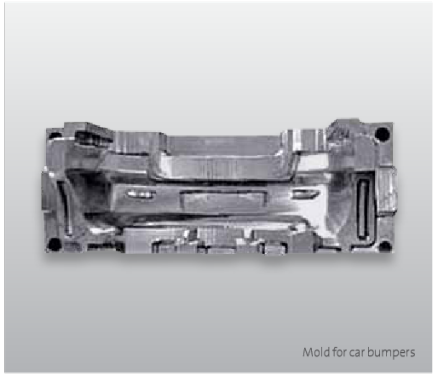
Plastic Mold Steel_TP1, TP4, TP4M

Steel materials used for molds that are utilized to inject molds.

Chemical Composition

SeAH CSS	JIS	AISI	DIN	Chemical composition (Wt, %)								Applications
				C	Si	Mn	P	S	Ni	Cr	Mo	
TP1				0.50 0.55	0.35	0.90	0.03	0.02	-	-	-	Molds for general merchandise, base materials for precision parts
TP4	SCM improved	4140 improved	1.2311 improved	0.26 0.43	0.15 0.35	0.80 1.15	0.025	0.020	0.45	0.90 1.50	0.20 0.30	Car bumper molds, radiator grills, OA equipment, cabinets, back covers of TVs and PCs, molds for consumer electronics and more
TP4M	SNCM improved	P20 improved	1.2738 improved	0.26 0.37	0.15 0.35	0.80 1.00	0.025	0.020	0.55	1.65 2.10	0.40 0.50	
			1.2311	0.35 0.45	0.20 0.40	1.30 1.60	0.035	0.035	-	1.80 2.10	0.15 0.25	High end car bumper molds, radiator grills, OA equipment, cabinets, back covers of TVs and PCs, molds for consumer electronics and more
			1.2738	0.35 0.45	0.20 0.40	1.30 1.60	0.035	0.035	0.90 1.20	1.80 2.10	0.15 0.25	
			1.2312	0.35 0.45	0.30 0.50	1.40 1.60	0.030	0.050 0.100	-	1.80 2.00	0.15 0.25	
			1.2714	0.50 0.60	0.10 0.40	0.65 0.95	0.030	0.030	1.50 1.80	1.00 1.20	0.45 0.55	

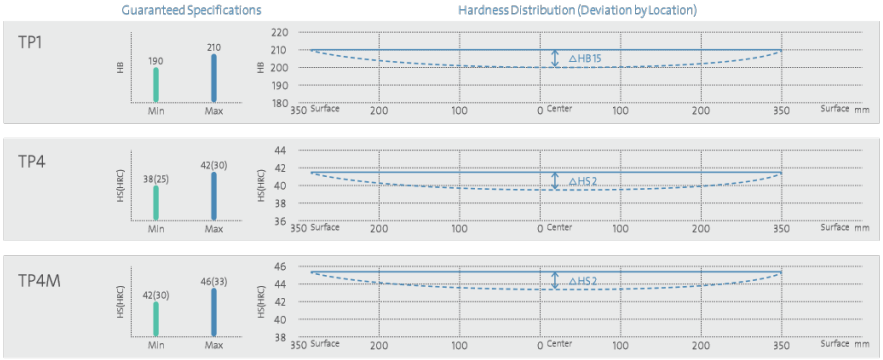
Applications



Mold for car bumpers

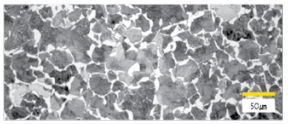
Mold for car head lamps

Hardness Distribution



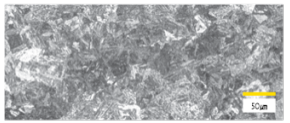
Microstructures

TP1 [Nor.+Temp]



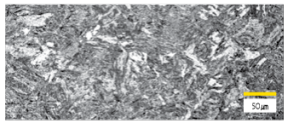
Pearlite+Ferrite

TP4 [Nor.+Qu.+Double Temp.]



Tempered Martensite

TP4M [Nor.+Qu.+Double Temp.]



Tempered Martensite

Thermal Expansion Co-efficient

(Unit : 10^{-6}/°C)

Temperature	TP1	TP4	TP4M
20~100°C	7.4	11.2	11.8
20~200°C	10.9	11.8	12.3
20~300°C	12.1	12.4	12.9
20~400°C	13.0	13.0	13.4
20~500°C	13.7	13.6	14.0
20~600°C	14.3	13.8	14.2

High Gloss Precision Plastic Mold Steel _ SMAT1

High gloss precision plastic mold material with high cleanliness and uniform structure.

Product Characteristics

Polishability	Impact toughness	Machinability	High cleanliness

Chemical Composition

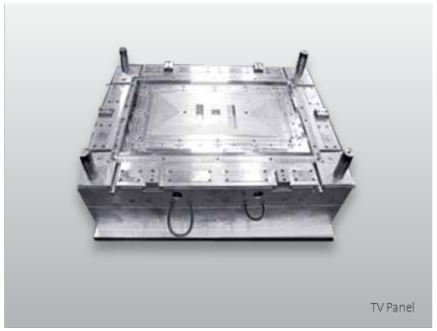
Grade	Chemical composition (Wt, %)							
	C	Si	Mn	Cr	Ni	Ai	V	Others
P21	0.18 0.22	0.20 0.40	0.20 0.40	0.20 0.30	3.90 4.25	1.05 1.25	0.15 0.25	-
SMAT1(aim)	0.1	0.3	1.5	0.8	3.0	1.0	-	Add.

Mechanical Properties

Grade	Yield strength [N/mm²]	Tensile strength [N/mm²]	Elongation [%]	Cross-section reduction[%]	Hardness [HRc]	Impact toughness [J/cm²]
SMAT1	1,000~1,200	1,100~1,300	>14	>45	37~41	>45

Applications

- High gloss molds for mobile phone cases, consumer electronics, OA machines, automobile parts (headlamps, fog lights).
- High gloss TV front panels and high precision plastics.

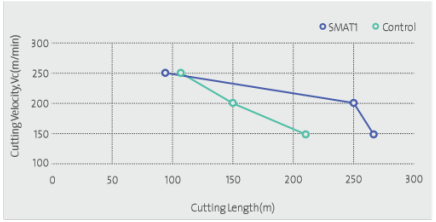

TV Panel


TV Panel

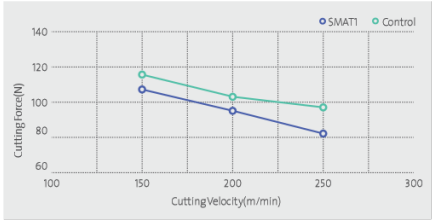
Machinability

- Excellent end-mill Machinability

Through put Based on Cutting Speed



Cutting Force Measurement Result

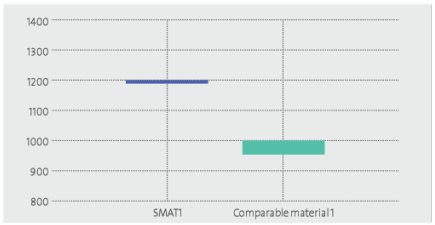


Polishability

- No pit or wave mark formed after lapping (#1200).

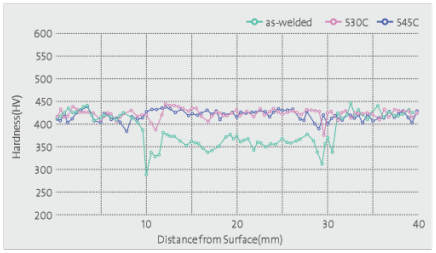
SMAT1's Polishability

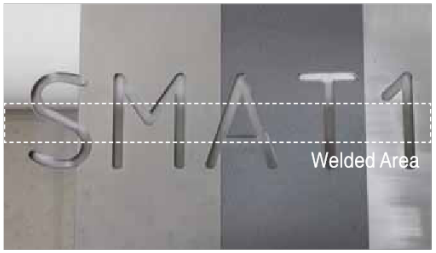
Glossiness Measurement Result



Weldability

- No weld line formed after lapping due to its outstanding recovering ability.





Precision Plastic Mold Steel with Excellent Machinability_ SMAT E

High gloss precision plastic mold materials that have excellent workability and polishability through special refining and heat treatment technics.

Product Characteristics

Excellent Machinability	Polishability	Impact toughness	High cleanliness

Chemical Composition

Grade	Chemical composition (Wt, %)					
	C	Si	Mn	Cr	Mo	Others
P20	0.28 0.40	0.20 0.80	0.60 1.00	1.40 2.00	0.30 0.55	-
SMAT E	0.25	0.25	1.5	1.4	0.6	Add.

Mechanical Properties

Grade	Yield strength [N/mm²]	Tensile strength [N/mm²]	Elongation [%]	Cross-section reduction[%]	Hardness [HRc]	Impact toughness [J/cm²]
SMAT E	1,000~1,200	1,100~1,300	>14	>45	37~41	>45

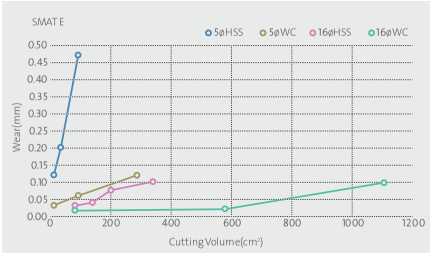
Applications

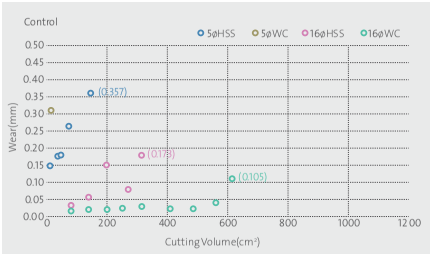
Molds for high polishability/gloss injection(i.e.TV panels),molds for precision injection requiring complicated shaping process,and rubber molds requiring numerous machine processing operations(electric electronic parts).

Machinability

End Mill

- Excellent in End-mill Machinability





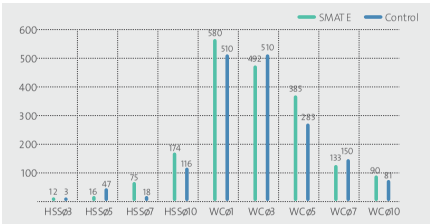
Gun Drill Drilling

-Excellent in gun-drill machinability.

Grade	ø30			ø18			ø10			ø5		
	RPM	Feed Rate	Hole	RPM	Feed Rate	Hole	RPM	Feed Rate	Hole	RPM	Feed Rate	Hole
SMAT E	389	30	9	800	40	6	1,400	50	6EA	3,000	24	27
Control	389	30	0	800	40	1	1,400	50	1EA	3,000	12	1

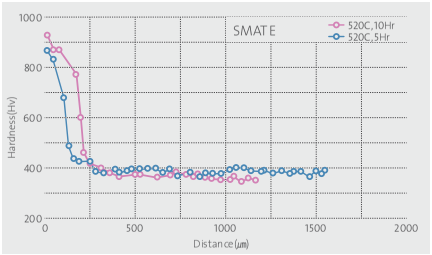
(Unit:m/min, ea)

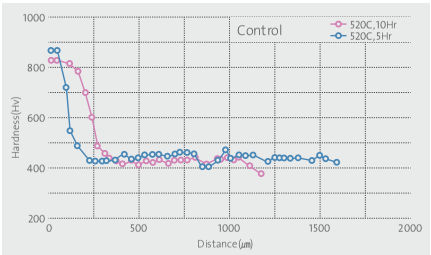
After measuring processed holes based on the tool's quality and size,SMATE stays at about the same or the higher level than the control material shown in the figure.



Nitriding Properties

As shown in the figure,'520°C,5Hr' values prove that they have an outstanding nitriding quality.
Their nitriding depth is about 0.2μm and initial hardness is about 880Hv.





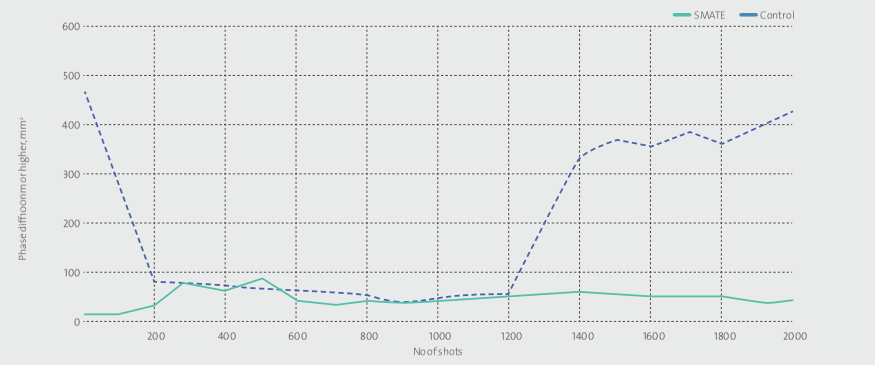
Precision Plastic Mold Steel with Excellent Machinability_ SMAT E

Applications

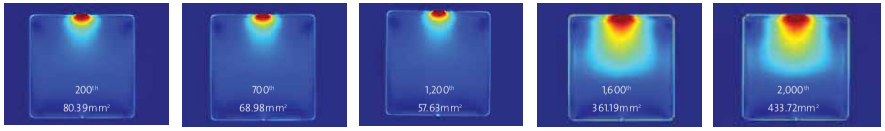
Application area	Measurement items
Lens core mold	- Injection mold (double refraction analysis and measurement) - Core damage measurement after giving shots for 2,000 times

Measurement of Double Refraction after Injection

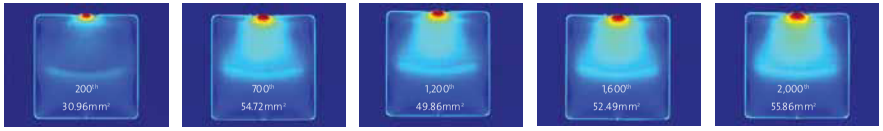
- SMATE's double refraction rate is more constant and shows less deviation than the control material.



Control Material



SMATE

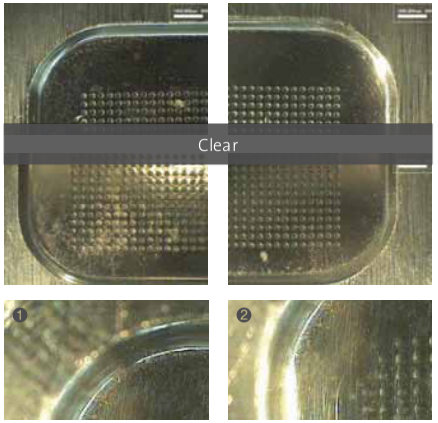


* Measurement Range:More than 110 nm. A range from red to yellow.

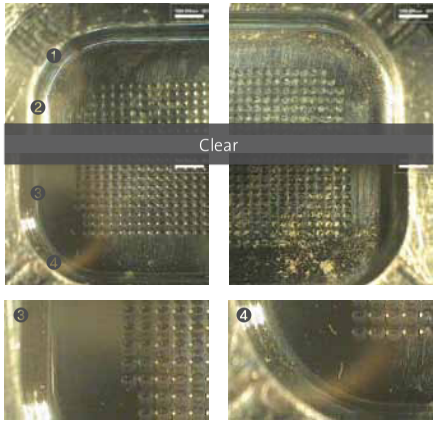
Mold Damage Observation

- SMAT E's surface still shows satisfactory condition after giving shots for 2,000 times.

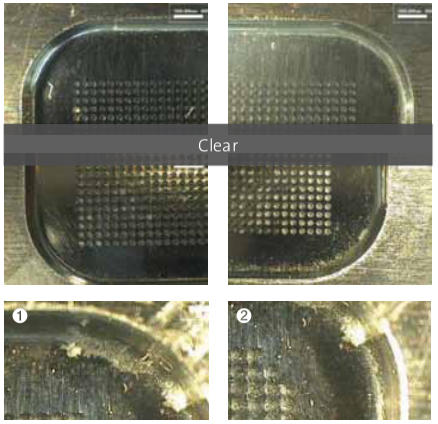
SMAT E's Upper Core



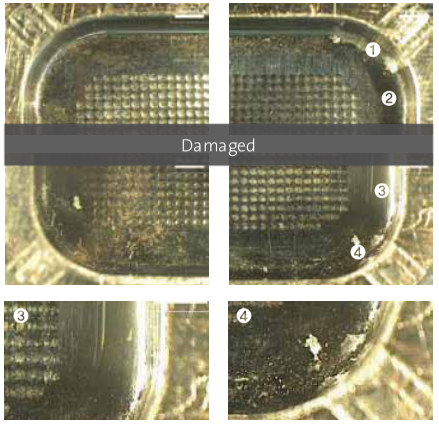
SMAT E's Bottom Core



Control Material's Upper Core



Control Material's Bottom Core



Flame Hardened Tool Steel_ PST23F85

By utilizing flame, the flame hardened tool steel is produced through surface hardening heat treatment. This tool steel's hardenability can be increased by adding Cr and Mn.The addition of Si also leads to enhance its hardenability. Furthermore, the portion of the C is a factor to control its hardness.

Product Characteristics

Cost can be saved through flame surface heat treatment	High strength and wear resistance at the surface

Chemical Composition

Grade	Chemical Composition (Wt, %)				
	C	Si	Mn	Cr	Mo
PST23F85	0.80 0.90	0.80 1.20	0.70 1.10	1.80 2.20	0.20 0.30

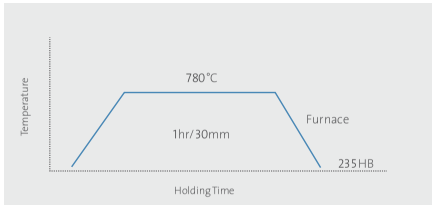
Applications

Molds for automobile parts, blanking dies, forming dies, trimming dies, and shear blades

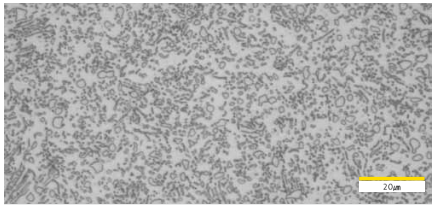

Mold for car part


Product

Spheroidizing Annealing

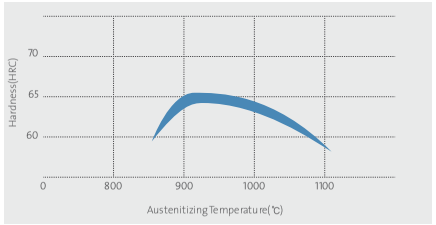


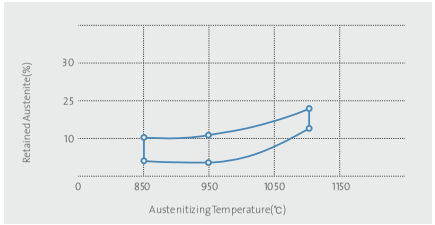
Microstructures



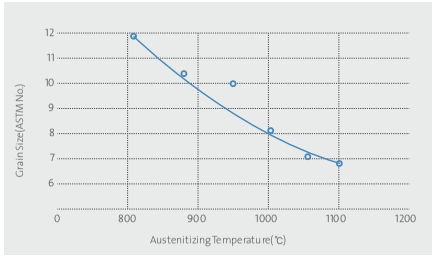
Hardness and Retained Austenite Distribution Based on the Flame Temperature

HRC distribution ranges from 62 to 65 in the temperature of 900~950°C. Hardness lowered between 1,000~1,100°C due to increasing retained Austenite content.

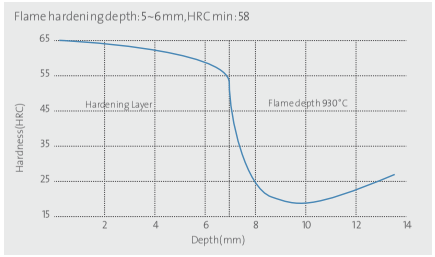




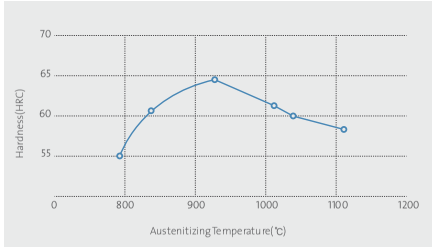
Grain Size Based on Flame Temperature

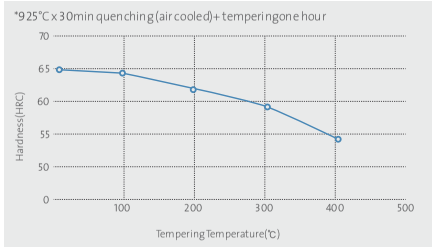


Hardening Depth



Quenching and Tempering Heat Treatment Properties





Pre-hardened Tool Steel_ SKT4(V)

Provided as in the condition of Q/T heat treated. Mold machining customer can use material as mold without additional heat treatment.

Product Characteristics

Excellent Machinability	Outstanding thermal resistance	Impressive wear resistance	Uniform hardness

Chemical Composition

Grade	Chemical composition (Wt, %)						
	C	Si	Mn	Ni	Cr	Mo	V
SKT4	0.50 0.60	0.10 0.40	0.60 0.90	1.50 1.80	0.80 1.20	0.35 0.55	0.05 0.15
SKT4V*	0.55	0.35	0.80	1.50	1.10	0.33	0.18

(*) Upgraded version of SKT4: Higher resistance to abrasion and heat

Applications

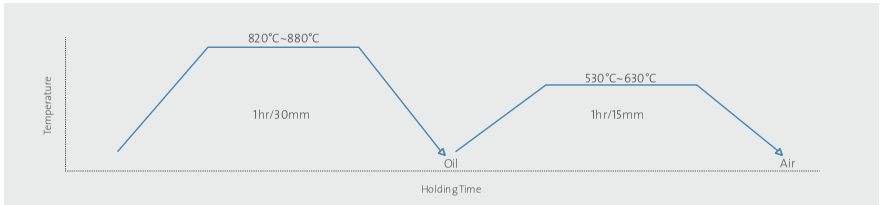
Tools for shaping materials in a hot state.

Hot Pressing Dies

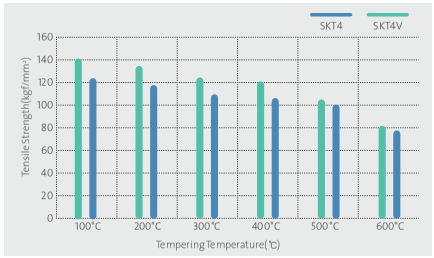
Hot Pressing Dies

* Dies for form forging
* Extrusion dies
* Press molds
* Die casting dies

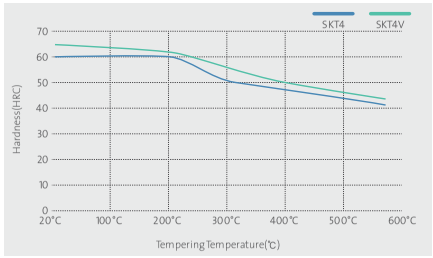
Heat Treatment Conditions for Quenching &Tempering



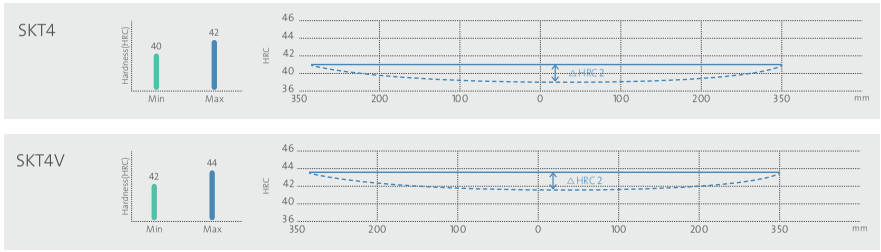
Tensile Strength Based on Tempering temperatures



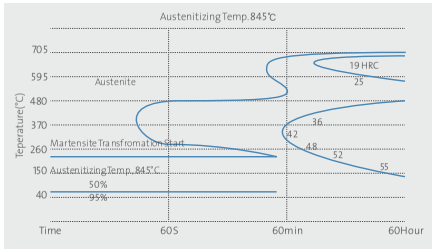
Determining Hardness at High Temperatures



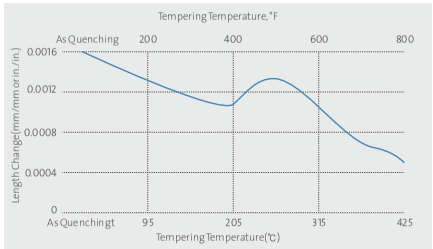
Hardness Distribution



TTT Curve



Dimension Change



Forged Rolls

Work rolls used for cold rolling mills that press steel plates applied to automobiles and electronic products.

Chemical Composition

Grade	Chemical composition (Wt, %)						
	C	Si	Mn	Ni	Cr	Mo	V
PSTR-12	1.50	0.50	0.50	0.20	12.0	1.00	0.80
PSTR-2	0.50	1.10	0.40	0.20	5.00	1.30	0.60
PSTR3505C	0.90	0.65	0.35	-	3.20	0.20	-
PSTR-5	0.90	0.30	0.45	Add	5.00	0.45	Add

Applications

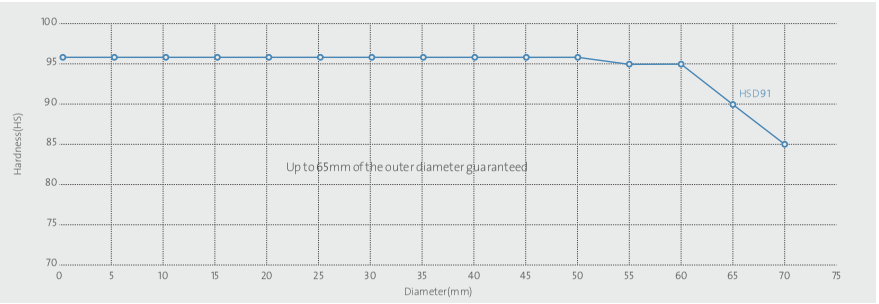
- PSTR-12(SKD11 Modify) : Z/Mill Work Roll
- PSTR-2(SKD62 Modify) : Z/Mill 1st / 2nd Roll
- PSTR3505C : 3% Cr Steel(General)
- PSTR-5 : 5% Cr Steel(Electrical Plate Mill WR, Cold Rolled Mill WR/IMR)

*WR : Work Roll, IMR : Intermediate Roll

Work Roll

Depth Hardness Distribution

* Hardness of work rolls for cold rolling steel plates applied to automobiles: HSD 96±1(HSD 91Up)



Applications

POSCO	Pohang	No.1 CR Shop	5% Cr Steel (ESR) W/R
		No.2 CR Shop	5% Cr Steel (ESR) W/R
		Electrical Plate Shop	5% Cr Steel (ESR) W/R, Z/Mil
		STS CR Shop	Z/Mill
	Gwangyang	No.1 CR Shop	5% Cr Steel (ESR) W/R
		No.2 CR Shop	5% Cr Steel (ESR) W/R
		No.3 CR Shop	5% Cr Steel (ESR) W/R
		No.4 CR Shop	5% Cr Steel (ESR) W/R
	India	CR Shop	5% Cr Steel (ESR) W/R
DHF	Japan	CR Shop	3% Cr Intermediate Roll
HYUNDAI HYSCO		CR Shop	5% Cr Steel (ESR) W/R
BNG STEEL		STS CR Shop	Z/Mill
SeAH STEEL		CR Shop	3% Cr Intermediate Roll

Specifiactions

Type	Standard	Grade	Chemical composition (Wt, %)										Annealing temp.(°C)	Annealing hardness	Heat treatment temp. (°C)		Hardness	Applications
			C	Si	Mn	P	S	Ni	Cr	Mo	V	Others			Quenching	Tempering		
Carbon Tool steel	KS	STC3(STC105)	1.00 1.10	0.10 0.35	0.10 0.50	0.03	0.03						750~780 Furnace cooling	HB 212 Max	780 Water Cooling	180 Air cooling	HRC Min 61	
	JIS	SK3(SK105)	1.00 1.10	0.10 0.35	0.10 0.50	0.03	0.03						750~780 Furnace cooling	HB 212 Max	780 Water Cooling	180 Air cooling	HRC Min 61	Press frames, clamping tools chisels, drills, hammers
	ASTM	W1	0.95 1.05	0.10 0.40	0.10 0.40	0.03	0.03	0.20	0.15	0.10	0.10	Cu : Max 0.20 W : Max 0.15	730~760 Furnace cooling	HB 202 Max	760~820 Water Cooling	150~200 Air cooling	HRC Min 61	
Cold work Tool steel	KS	STD11	1.40 1.60	0.40	0.60	0.03	0.03	0.50	11.00 13.00	0.80 1.20	0.20 0.50		830~880 Furnace cooling	HB 255 Max	1030 Air cooling	180 Air cooling	HRC Min 58	
	JIS	SKD11	1.40 1.60	0.40	0.60	0.03	0.03		11.00 13.00	0.80 1.20	0.20 0.50		830~880 Furnace cooling	HB 255 Max	1030 Air cooling	180 Air cooling	HRC Min 58	
	ASTM	D2	1.40 1.60	0.10 0.60	0.10 0.60	0.03	0.03	0.40	11.00 13.00	0.70 1.20	0.50 1.10		830~880 Furnace cooling	HB 255 Max	1010 Air cooling	204 Air cooling	HRC Min 59	
		D3	2.00 2.35	0.10 0.60	0.10 0.60	0.03	0.03	0.50	11.00 13.50		1.00	W : Max1.0	830~880 Furnace cooling	HB 255 Max	968 Oil cooling	204 Air cooling	HRC Min 61	Cold dies, presses, tools, press dies
		D4	2.05 2.40	0.10 0.60	0.60	0.03	0.03		11.00 13.00	0.70 1.20	0.15 1.00		830~880 Furnace cooling	HB 255 Max	996 Air cooling	204 Air cooling	HRC Min 62	
	DIN	WNR1.2379	1.50 1.60	0.10 0.40	0.15 0.45	0.03	0.03		11.00 12.00	0.60 0.80	0.90 1.10		830~880 Furnace cooling	HB 255 Max	1010 Air cooling	204 Air cooling	HRC Min 58	
		WNR1.2080	1.90 2.20	0.10 0.40	0.15 0.45	0.03	0.03		11.00 12.00				830~880 Furnace cooling	HB 248 Max	996 Air cooling	204 Air cooling	HRC Min 60	
	SeAH CSS	TD1	Patent										180~520 Air cooling	HB 255 Max	1030 Air cooling	180/520 Air cooling	HRC Min 58	
Hot work Tool steel	KS	STF4	0.50 0.60	0.10 0.40	0.60 0.90	0.03	0.02	1.50 1.80	0.80 1.20	0.35 0.55	0.05 0.15		740~800 Furnace cooling	HB 248 Max	850 Oil cooling	500 Air cooling	HRC Min 42	
		STD61	0.35 0.42	0.80 1.20	0.25 0.50	0.03	0.02	0.25	4.80 5.50	1.00 1.50	0.80 1.15		820~870 Furnace cooling	HB 229 Max	1020 Air cooling	550 Air cooling	HRC Max 50	
		STD62	0.32 0.40	0.80 1.20	0.20 0.50	0.03	0.02		4.75 5.50	1.00 1.60	0.20 0.50	W : 1.0~1.6	820~870 Furnace cooling	HB 229 Max	1020 Air cooling	550 Air cooling	HRC Max 48	
		STD6	0.32 0.42	0.80 1.20	0.20 0.50	0.03	0.02		4.50 5.50	1.00 1.50	0.30 0.50		820~870 Furnace cooling	HB 229 Max	1050 Air cooling	550 Air cooling	HRC Max 48	
	JIS	SKT4	0.50 0.60	0.10 0.40	0.60 0.90	0.03	0.02	1.50 1.80	0.80 1.20	0.35 0.55	0.05 0.15		740~800 Furnace cooling	HB 248 Max	850 Oil cooling	500 Air cooling	HRC Min 42	
		SKD61	0.35 0.42	0.80 1.20	0.25 0.50	0.03	0.02		4.80 5.50	1.00 1.50	0.80 1.15	W : 1.0~1.5	820~870 Furnace cooling	HB 229 Max	1020 Air cooling	550 Air cooling	HRC Min 50	
		SKD62	0.32 0.40	0.80 1.00	0.20 0.50	0.03	0.03		4.75 5.50	1.00 1.50	0.20 0.60	W : 1.0~1.5	820~870 Furnace cooling	HB 229 Max	1020 Air cooling	550 Air cooling	HRC Min 48	
		SKD6	0.33 0.43	0.80 1.25	0.20 0.60	0.03	0.03		4.75 5.50	1.10 1.60	0.30 0.60		820~870 Furnace cooling	HB 229 Max	1050 Air cooling	550 Air cooling	HRC Min 48	Extrusion dies, Die casting dies, forging dies, head dies, shearing knives
	ASTM	H13	0.32 0.45	0.80 1.25	0.20 0.60	0.03	0.03		4.75 5.50	1.10 1.75	0.80 1.20		820~870 Furnace cooling	HB 235 Max	1010 Air COOLING	552 Air cooling	HRC Min 52	
		H12	0.32 0.40	0.80 1.00	0.20 0.50	0.03	0.03		4.75 5.50	1.00 1.50		W : 1.0~1.5	820~870 Furnace cooling	HB 235 Max	1010 Air cooling	552 Air cooling	HRC Min 53	
		H11	0.33 0.43	0.80 1.25	0.20 0.60	0.03	0.03		4.75 5.50	1.10 1.60	0.30 0.60		820~870 Furnace cooling	HB 235 Max	1010 Air cooling	552 Air cooling	HRC Min 53	
	DIN	WNR1.2344	0.37 0.43	0.90 1.20	0.30 0.50	0.03	0.03		4.80 5.50	1.20 1.50	0.90 1.10		750~780 Furnace cooling	HB 229 Max	1010~1030 Oil cooling	540~560 Air cooling	HRC Min 50	
		WNR1.2343	0.36 0.42	0.90 1.20	0.30 0.50	0.03	0.03		48.0 5.50	1.10 1.40	0.25 0.50		750~780 Furnace cooling	HB 229 Max	1010~1030 Oil cooling	540~560 Air cooling	HRC Min 48	
		WNR1.2767	0.40 0.50	0.10 0.40	0.15 0.45	0.03	0.03	3.80 4.30	1.20 1.50	0.15 0.35			610~650 Furnace cooling	HB 285 Max	840~860 Oil cooling	170~190 Air cooling	HRC Min 52	
	SeAH CSS	SKT4V	0.50 0.60	0.35	0.70 1.00	0.025	0.02	1.30 2.00	1.00 1.40	0.25 0.50	0.10 0.30	Al : 0.02~0.03 Nb : 0.03~0.04	760~780 Furnace cooling	HB 241 Max	850 Oil cooling	550 Air cooling	HRC Min 40	
		PST27K57V	0.55 0.60	1.00 1.20	0.50	0.03	0.03	0.80 1.20	4.50 5.50	1.40 1.60	0.80 1.20	Cu : Max 0.25	860~870 Furnace cooling	HB 241 Max	1010 Oil cooling	550 Air cooling	HRC Min 55	
		DC1	Patent										820~870 Furnace cooling	HB 229 Max	1020 Air cooling	550 Air cooling	HRC Min 50	
Plastic Mold steel	SeAH CSS	TP1	0.50 0.55	0.35	0.90	0.03	0.02						Prehardened steel			540~590 Air cooling	HB Max 215	Molds for general merchandise, base materials for precision parts
		TP4	0.26 0.43	0.15 0.35	0.80 1.15	0.025	0.02	0.45	0.90 1.50	0.20 0.30	0.02 0.04	special Alloy added			850~890 Oil cooling	540~620 Air cooling	HS Min 38	Molds for auto bumpers, OA machines, TV & PC back covers
		TP4M	0.26 0.37	0.15 0.35	0.80 1.00	0.025	0.02	0.30 0.55	1.65 2.10	0.40 0.50					850~890 Oil cooling	540~620 Air cooling	HS Min 40	
		SMAT1	Patent															
		SMAT E	Patent															

Specifiactions

Type	Standard	Grade	Chemical composition (Wt, %)										Annealing temp.(°C)	Annealing hardness	Heat treatment temp. (°C)		Hardness	Applications
			C	Si	Mn	P	S	Ni	Cr	Mo	V	Others			Quenching	Tempering		
Plastic Mold Steel	DIN	WNR1.2311	0.35 0.45	0.20 0.40	1.30 1.60	0.04	0.04		1.80 2.10	0.15 0.25			850~890 Air cooling	HB 230 Max	850~890 Oil cooling	540~620 Air cooling	HS Min 38	Molds for high end auto bumpers and consumer electronics
		WNR1.2312	0.35 0.45	0.30 0.50	1.40 1.60	0.03	0.05 0.10		1.80 2.00	0.15 0.25			850~890 Air cooling	HB 230 Max	850~890 Oil cooling	540~620 Air cooling	HS Min 38	
		WNR1.2714	0.50 0.60	0.10 0.40	0.65 0.90	0.03	0.03	1.50 1.80	1.00 1.20	0.45 0.55	0.07 0.12		850~890 Air cooling	HB 245 Max	850~890 Oil cooling	540~620 Air cooling	HS Min 38	
		WNR1.2738	0.35 0.45	0.20 0.40	1.30 1.60	0.04	0.04	0.90 1.20	1.80 2.10	0.15 0.25			850~890 Air cooling	HB 240 Max	850~890 Oil cooling	540~620 Air cooling	HS Min 42	
Air hardened Tool Steel	ASTM	A2	0.95 1.05	0.10 0.50	0.40 1.00	0.03	0.03		4.75 5.50	0.90 1.40	0.15 0.50		830~880 Furnace cooling	HB 255 Max	954 Air cooling	204 Air cooling	HRC Min 60	Forming dies, punches
		A6	0.65 0.75	0.10 0.70	1.80 2.50	0.03	0.03		0.90 1.40	0.90 1.40	0.15 0.50		770~790 Furnace cooling	HB 248 Max	843 Air cooling	204 Air cooling	HRC Min 58	
		A8	0.50 0.60	0.75 1.10	0.20 0.50	0.03	0.3		4.75 5.50	1.15 1.65		W : 1.0~1.5	770~790 Furnace cooling	HB 241 Max	1010 Air cooling	510 Air cooling	HRC Min 56	
	DIN	WNR1.2363	0.90 1.05	0.20 0.40	0.40 0.70	0.035	0.035		4.80 5.50	0.90 1.20	0.10 0.30		770~790 Furnace cooling	HB 230 Max	950 Air cooling	180 Air cooling	HRC Min 60	Forming dies, punches
Oil hardened Tool Steel	KS	STS95	0.80 0.90	0.50	0.80 1.10	0.03	0.03		0.20 0.60				730~760 Furnace cooling	HB 212 Max	820 Oil cooling	180 Air cooling	HRC Min 59	Ring gauges, pulling dies
		STS3	0.90 1.00	0.35	0.90 1.20	0.03	0.03		0.50 1.00			W : 0.5~1.0	750~800 Furnace cooling	HB 217 Max	830 Oil cooling	180 Air cooling	HRC Min 60	Screw cutters, cutting knives
		STS93	1.00 1.10	0.50	0.80 1.10	0.03	0.03		0.20 0.60				750~780 Furnace cooling	HB 217 Max	820 Oil cooling	180 Air cooling	HRC Min 63	Blades, press frames
	JIS	SKS95	0.80 0.90	0.50	0.80 1.10	0.03	0.03		0.20 0.60				730~760 Furnace cooling	HB 212 Max	820 Oil cooling	180 Air cooling	HRC Min 59	Ring gauges, pulling dies
		SKS3	0.90 1.00	0.35	0.90 1.20	0.03	0.03		0.50 1.00			W : 0.5~1.0	750~800 Furnace cooling	HB 217 Max	830 Oil cooling	180 Air cooling	HRC Min 60	Screw cutters, cutting knives
		SKS93	1.00 1.10	0.50	0.80 1.10	0.03	0.03		0.20 0.60				750~780 Furnace cooling	HB 217 Max	820 Oil cooling	180 Air cooling	HRC Min 63	Blades, press frames
	ASTM	O1	0.85 1.00	0.10 0.50	1.00 1.40	0.03	0.03		0.40 0.70		0.30	W : 0.4~0.6	750~800 Furnace cooling	HB 212 Max	802 Oil cooling	204 Air cooling	HRC Min 59	Cold molding dies, forming rolls
		O6	1.25 1.55	0.55 1.50	0.30 1.10	0.03	0.03		0.30	0.20 0.30			730~760 Furnace cooling	HB 212 Max	802 Oil cooling	204 Air cooling	HRC Min 59	Ring gauges, pulling dies
		O2	0.85 0.95	0.50	1.40 1.80	0.03	0.03		0.50	0.30	0.30		750~770 Furnace cooling	HB 217 Max	802 Oil cooling	204 Air cooling	HRC Min 59	Cold molding dies, forming rolls
	DIN	WNR1.2510	0.90 1.05	0.15 0.35	1.00 1.20	0.035	0.035		0.50 0.70		0.05 0.15	W : 0.5~0.7	770~790 Furnace cooling	HB 229 Max	780~820 Oil cooling	180~220 Air cooling	HRC Min 61	Cold molding dies, forming rolls
		WNR1.2842	0.85 0.95	0.10 0.40	1.90 2.10	0.03	0.03		0.20 0.50		0.05 0.15		750~770 Furnace cooling	HB 229 Max	790~820 Oil cooling	150~250 Air cooling	HRC Min 60	
Shock resisting Tool steel	KS	STS41	0.35 0.45	0.35	0.50	0.03	0.03		1.00 1.50			W : 2.5~3.5	760~820 Furnace cooling	HB 217 Max	880 Oil cooling	180 Air cooling	HRC Min 53	Dies for hot forging
	JIS	SKS41	0.35 0.45	0.35	0.50	0.03	0.03		1.00 1.50			W : 2.5~3.5	760~820 Furnace cooling	HB 217 Max	880 Oil cooling	180 Air cooling	HRC Min 53	Dies for hot forging
	ASTM	S1	0.40 0.55	0.15 1.20	0.10 0.40	0.03	0.03		1.00 1.80	0.50	0.15 0.30	W : 1.5~3.0	760~820 Furnace cooling	HB 217 Max	954 Oil cooling	204 Air cooling	HRC Min 56	Dies for hot forging
		S5	0.50 0.65	1.75 2.25	0.60 1.00	0.03	0.03		0.10 0.50	0.20 1.35	0.15 0.35		830~850 Furnace cooling	HB 229 Max	899 Oil cooling	204 Air cooling	HRC Min 58	Cutter blades, punches
		S7	0.45 0.55	0.20 1.00	0.20 0.90	0.03	0.03		3.00 3.50	1.30 1.80	0.35		830~850 Furnace cooling	HB 229 Max	954 Air cooling	204 Air cooling	HRC Min 56	
Forged Rolls	SeAH CSS	PSTR-1	1.30 1.70	0.70	0.70	0.03	0.03	0.50	11.00 13.00	0.70 1.30	0.50 1.00	Co : 0.2~0.5	860~880 Furnace cooling	HB 225 Max	Heat treatment at low, medium or high frequency * As per customer's requirements		HS Min 90	Z-mills and cold rollers
		PST23R11	1.40 1.55	0.40	0.60	0.03	0.03	0.50	11.00 12.50	1.55 1.70	0.70 0.95	Co : 0.3~0.5	860~880 Furnace cooling	HB 225 Max			HS Min 90	
		PSTR-2	0.30 0.60	1.30	0.70	0.03	0.03	0.50	4.00 6.00	0.80 1.70	0.82	W : Max 1.5	860~880 Furnace cooling	HB 229 Max			HS Min 90	
		PSTR-5	0.75 0.95	0.20 0.50	0.20 0.50	0.025	0.015	0.50	4.50 5.50	0.40 0.65	-	-	860~880 Furnace cooling	HB 229 Max			HS Min 90	
		PSTR-12	1.30 1.70	0.70	0.70	0.03	0.03	0.50	11.00 13.00	0.70 1.30	0.50 1.00	Co : 0.2~0.5 Cu : Max 0.30	860~880 Furnace cooling	HB 245 Max			HS Min 90	
Flame hardened Tool steel	SeAH CSS	PST23F85	0.80 0.90	0.80 1.20	0.70 1.10	0.025	0.025		1.80 2.20	0.20 0.30	0.05 0.10		810~830 Furnace cooling	HB 235 Max	900~1000°C Flame		HRC Min 60	Cold molds

Classification of Tool Steel

SK3	Wear resistance	SK1	Wear resistance	SKD1 / SKD11	Cold work tool steel
			Wear resistance High temp. hardeness	SKH3 / SKH55	High speed tool steel
		SK2	Machinability	SKS2	Cold work tool steel
			Machinability High temp. hardeness	SKH2 / SKH51	High speed tool steel
	Impact resistance	SK5	Wear resistance Impact resistance	SKS3 / SKS31	Cutting tool steel with Impact resistance
			Impact resistance	SKS41	
			High temp. hardeness	SKD4	Hot work tool steel
			Impact resistance	SKD61	

Requirement	Substantial Alloy Elements
High temperature strength	W, Mo, Co (in combination with W or Mo), V, Cr, Mn
Wear resistance	V, W, Mo, Cr, Mn
Hardenability	Mn, Mo, Cr, Si, Ni, V
Transformation resistance	Mo (in combination with Cr), Cr, Mn
Toughness (grain refinement)	V, W, Mo, Mn, Cr (Al adjusted for others)
Resistance to oxidation for hot work tool steel	Cr, Si, Al

Product Size

Round Bars

•Rolled(5.7~340ø)•Forged(206~850ø)

Rolled Flat Bars

(Unit : mm)

	150≤W≤170	170<W≤220	220<W≤250	250<W≤310	310<W≤410	410<W≤510	510<W≤610	610<W≤1010
10≤T≤13	■	■	■	■				
13<T≤16	■	■	■	■	■			
16<T≤22	■	■	■	■	■	■		
22<T≤50	■	■	■	■	■	■	■	
50<T≤65	■	■	■	■	■	■	■	■
65≤T<110	■	■	■	■	■	■	■	■
110<T≤120		■	■	■	■	■	■	■
120<T≤130			■	■	■	■	■	■
130<T≤150			■	■	■	■	■	

Forged Flat Bars

(Unit : mm)

	200≤W ≤300	300<W ≤350	350<W ≤405	405<W ≤450	450<W ≤505	505<W ≤600	600<W ≤650	650<W ≤850	850<W ≤950	950<W ≤1000	1000<W ≤1100	1100<W ≤1250
150<T≤200	■	■	■	■	■	■	■	■	■			
200<T≤250	■	■	■	■	■	■	■	■	■	■		
250<T≤305		■	■	■	■	■	■	■	■	■	■	
305<T≤350		■	■	■	■	■	■	■	■	■	■	■
350<T≤400			■	■	■	■	■	■	■	■	■	■
400<T≤500				■	■	■	■	■	■	■	■	■
500<T≤550						■	■	■	■	■	■	
550<T≤600						■	■	■	■	■	■	
600<T≤650							■	■	■	■		
650<T≤700								■				

Plastic Mold Steel (Forged Flat Bars)

(Unit : mm)

	500≤W <600	600.1≤W <800	800≤W <1000	1000≤W <1100	1100≤W <1200	1200≤W <1300	1300≤W <1400	1400≤W <1600	1600≤W <1700	1700≤W ≤1900
200≤T≤300	■	■	■	■	■	■	■	■	■	
300<T≤500	■	■	■	■	■	■	■	■	■	■
500<T≤600	■	■	■	■	■	■	■	■	■	
600<T≤800		■	■	■	■	■	■	■	■	
800<T≤1000			■	■	■	■	■	■		
1000<T<1100				■	■	■	■			
1100<T≤1100					■	■	■			

Contact us for any order outside the dimensions above.

[T: Thickness, W: Width]

Packing Types

Flat bars

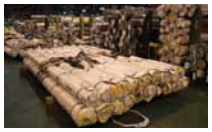
Bare

Hessian

Wooden Slate

Round bars

Bare



Hessian

Wooden Slate

Wooden Box

Tag & Label

Tag (for Domestics)

Tag (for Export)

Label (for Domestics)

Label (for Export)

Certificates of Approval

ISO 9001:2008
ISO QUALITY MANAGEMENT SYSTEM

ISO/TS 16949:2009
ISO QUALITY MANAGEMENT SYSTEM

ISO 14001:2004
ENVIRONMENTAL MANAGEMENT SYSTEM

KOSHA18001
KOSHA SAFE AND HEALTH MANAGEMENT SYSTEM

KOREAN INDUSTRIAL STANDARDS

JAPANESE INDUSTRIAL STANDARDS

KOREA ELECTRIC POWER INDUSTRY CODE

Order Requirements

We can only provide the right product for you when you fully specify what you need.
Be sure to provide detailed information for the line items below.
E-mail : trade@seah.co.kr / Website : www.seahss.co.kr/eng / Tel : +82 2 6970 2369 for questions

[1] Applicable standards: ASTM, JIS, DIN, etc. [2] Steel grade, Surface, Heat Treatment, Dimension

[3] Quantity and Delivery [4] Applications, method of processing [5] Special requirements (if applicable)