Daido's Hot Work Die Steel Series

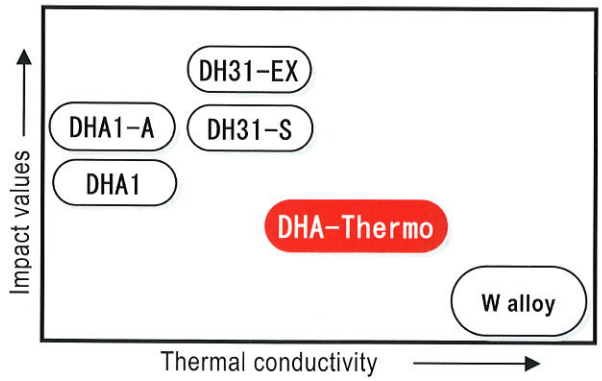
DHA-Thermo

High Thermal Conductivity Hot Work Die Steel

Features

High functional Hot Work Die Steel with 1.6 times higher thermal conductivity than SKD61 contributing to rapid cooling of die casting and low pressure casting tools such as core pins and sprue cores.

- High thermal conductivity contributes to rapid solidification and results in refined and improved cast structure with less defects.
- Reduced thermal load leads to longer life by lessening galling, soldering and heat checking behavior.
- Applying to the tools around gate helps to shorten cycle time due to faster solidification of casts.



Main applications

Recommended positions or parts	Applied tools	Hardness
・Where cast quality is required to be improved ・Where severely galled and heat checked	Insert	40～47HRC
	Core pins	42～47HRC
・Around gate such as biscuits when especially when shorter cycle time is aimed	Sprue bush ・ Sprue core Plunger chip	40～47HRC

◇Notes
- Sufficient inner cooling is required to exercise the characteristic of high thermal conductivity
- Available for small tools lighter than 40kg due to hardenability

Chemical composition

- Patent pending

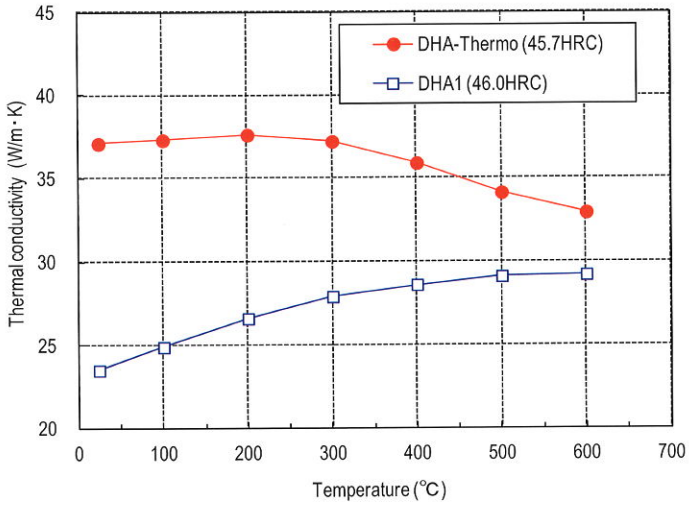
Heat treatment

Forging Temperature (℃)	Heat treatment (℃)			Hardness		Transformation Temp(℃)	
	Annealing	Quenching	Tempering	Annealing	Quenching Tempering	Ac	Ms
900～1200	820～870 Slow cooling And 650～700 Air cooling	1000～1030 Vacuum (≧4bar)	550～670 Air cooling	≦229HB	38～49 HRC	727～ 806	295(Austenitized at 1030℃)

DAIDO STEEL

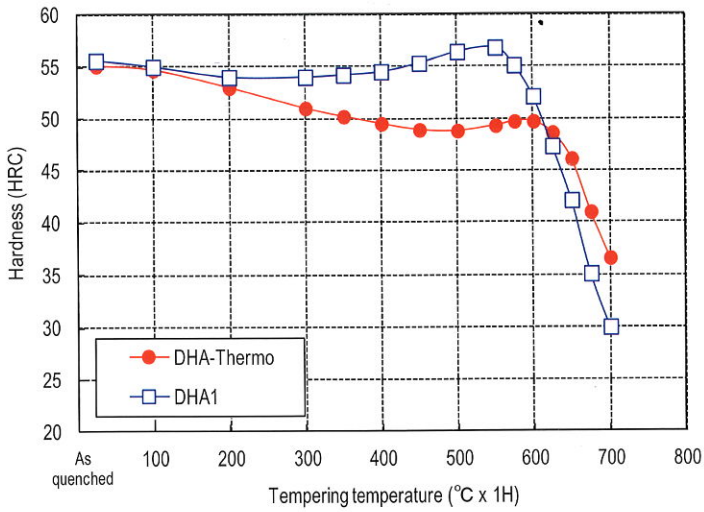
Thermal conductivity

Specimen : 10mm x 15mm x 20mm
Quenching : 1030℃, Gas cooling (6bar)



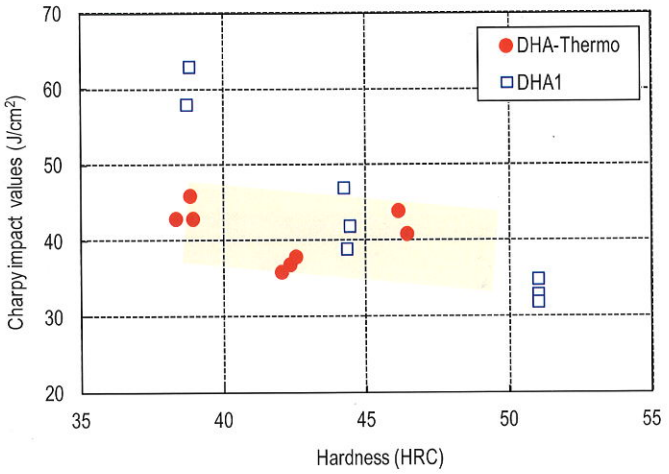
Tempering hardness

Specimen : 10mm x 15mm x 20mm
Quenching : 1030℃, Gas cooling (6bar)



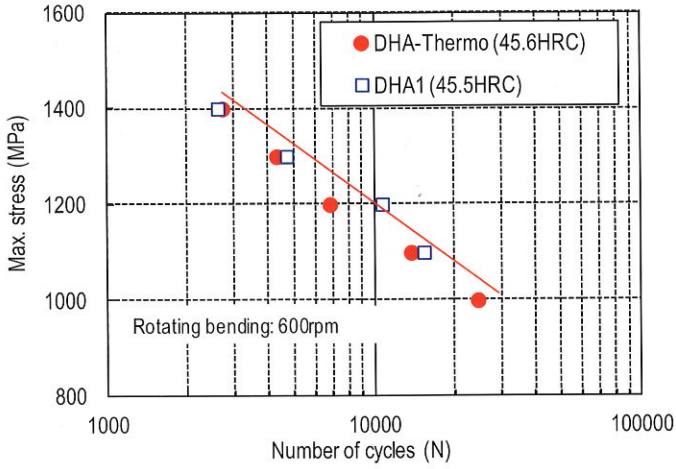
Toughness

Specimen : 10mm Square x 55mm
2mmU Notched, L direction
Quenching : 1030℃, Gas cooling (6bar)



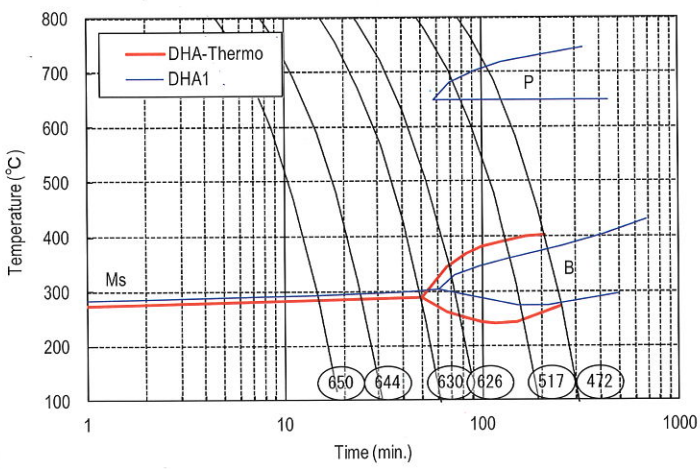
Fatigue properties

Specimen : φ 8 x 16mm L(Parallel portion)
Quenching : 1030℃, Gas cooling (6bar)



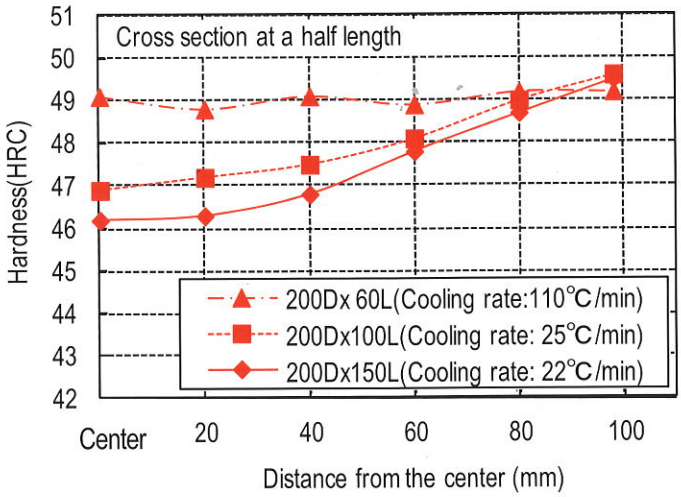
CCT curves

(Austenitizing temp.1030℃ x 15min)



Hardness distribution

Quenching : 1030℃, Gas cooling (4bar)
Tempering : 580℃ x 4H, Twice

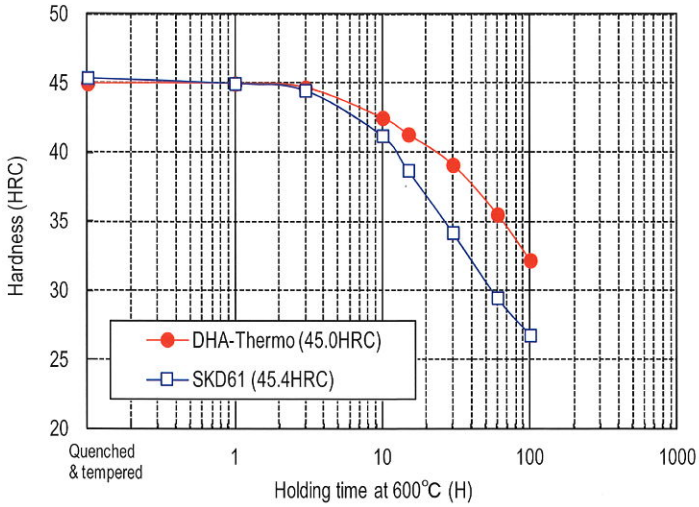


rties

Material size : 65mm x 65mm

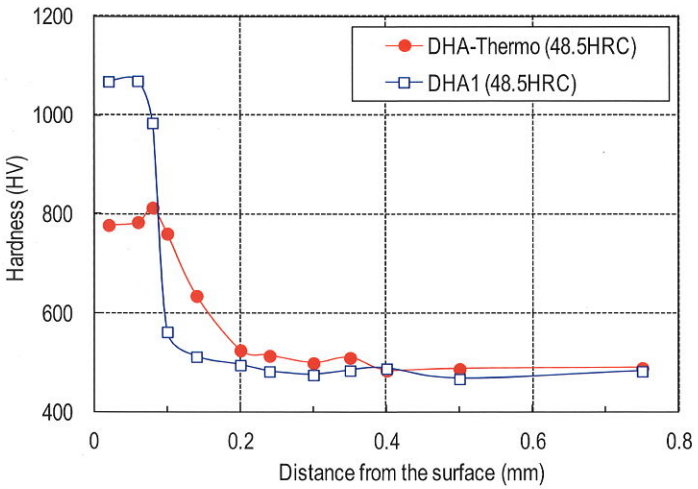
Softening resistance

Specimen:10mm x 15mm x 20mm
Quenching : 1030℃, Gas cooling (6bar)



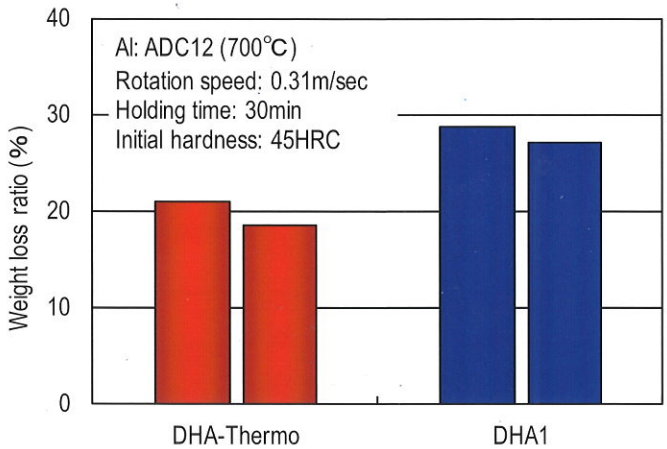
Nitriding characteristics

Quenching : 1030℃, Gas cooling (6bar)
Nitriding : PS treatment / Salt bath nitriding



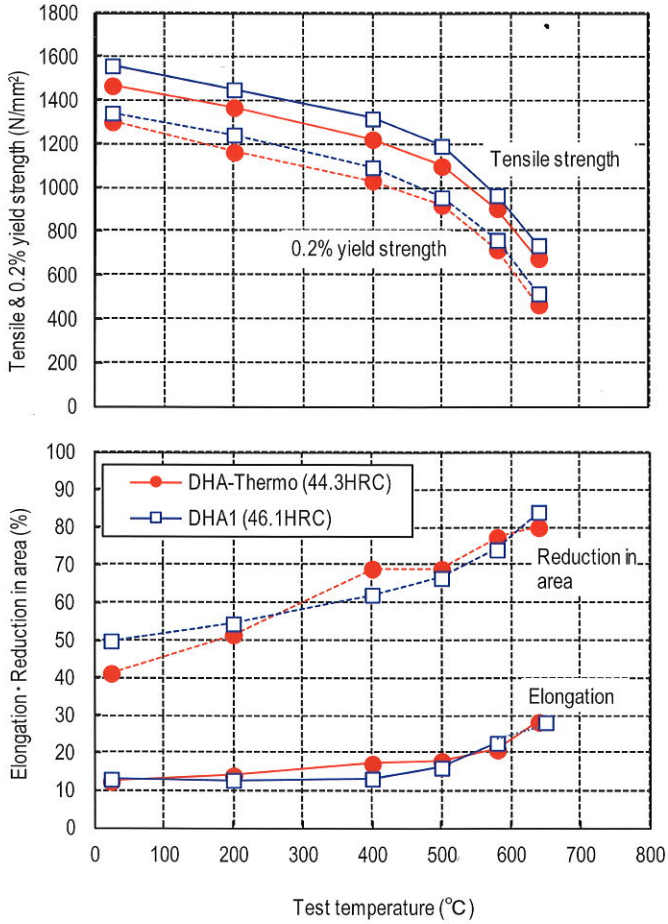
Al erosion resistance

Specimen : ϕ 10 x 30mm
Quenching : 1030℃, Gas cooling (6bar)



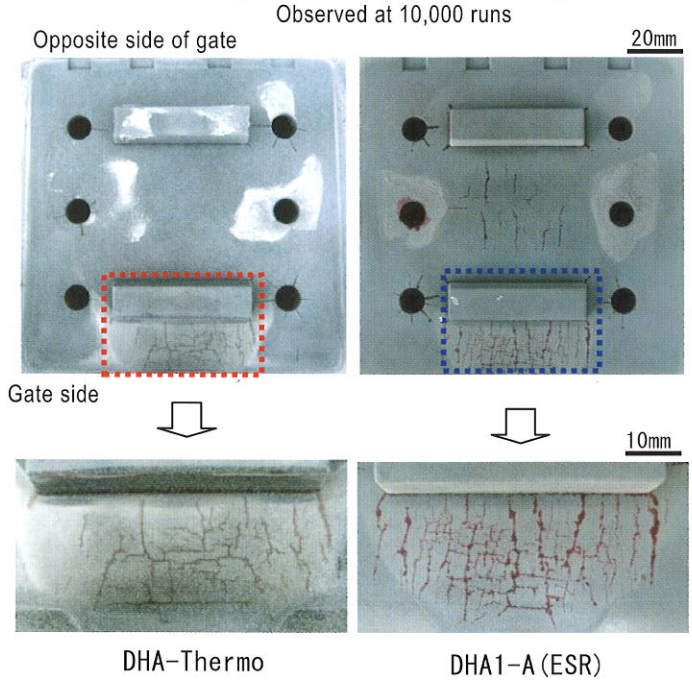
Mechanical properties

Specimen : ϕ 8 x 100mm, L direction
Quenching : 1030℃, Gas cooling (6bar)

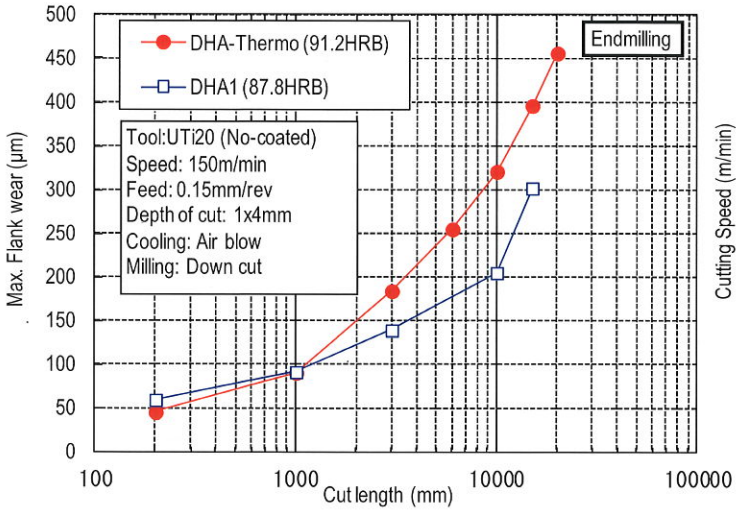


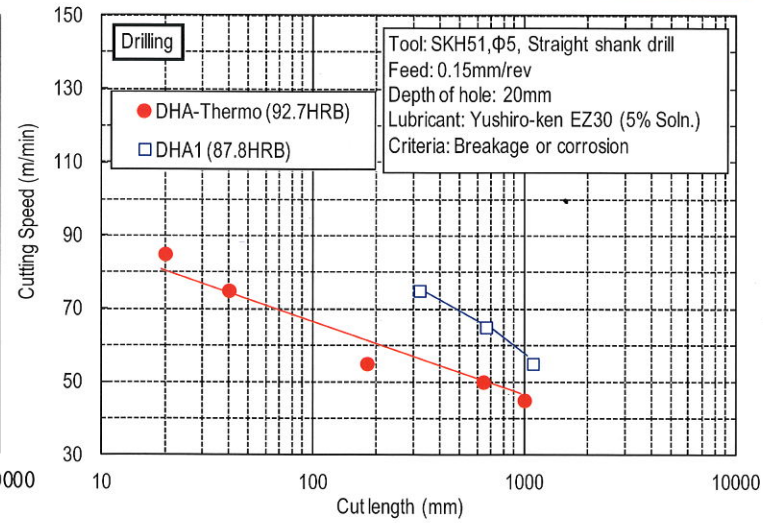
Heat checking resistance

Mold size : 62mm x 200mm x 205mm(42HRC)
Quenching : 1030℃, Gas cooling (6bar)
Die casting : 135t machine, ADC12(700℃)
Observed at 10,000 runs



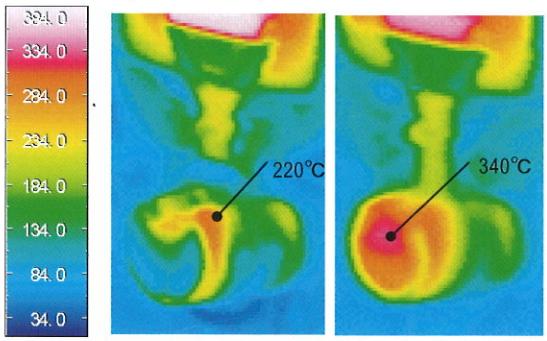
Machinability



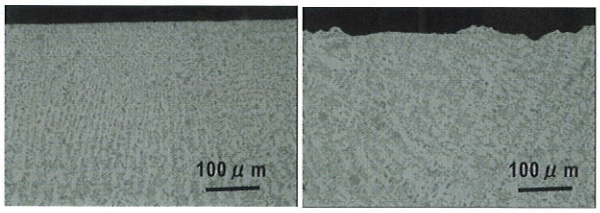


Application to sprue core

☐Surface temperature of sprue core



☐Cast structure of the biscuit contacted with DHA-Thermo



Physical properties

◆Thermal expansion rate

Temp.	20～100℃	20～200℃	20～300℃	20～400℃	20～500℃	20～600℃	20～700℃
X10^{-6}/K	12.0	12.8	13.3	13.8	14.1	14.3	14.4

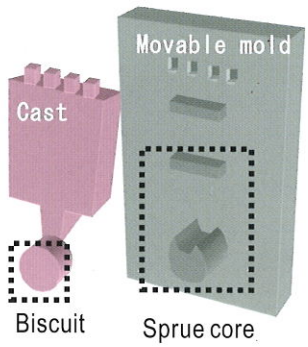
◆Thermal conductivity

Temp.	23℃	100℃	200℃	300℃	400℃	500℃	600℃
W/m·K	37.1	37.3	37.6	37.2	35.9	34.1	32.9

◆Specific heat

Temp.	23℃	100℃	200℃	300℃	400℃	500℃	600℃
J/kg·K [cal/g·℃]	443 [0.106]	471 [0.112]	506 [0.121]	550 [0.131]	601 [0.143]	660 [0.158]	728 [0.173]

※Heat treatment of the specimens
Quenching : 1030℃, Rapid cooling, Tempered to the hardness 45.7HRC



Machine	135t machine
Molten Al	ADC12、700℃
Cast product	650±15g 122X122X14mm
Cooling water	Sprue core, Plunger chip 2L/min(13～16℃)

DAIDO STEEL

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