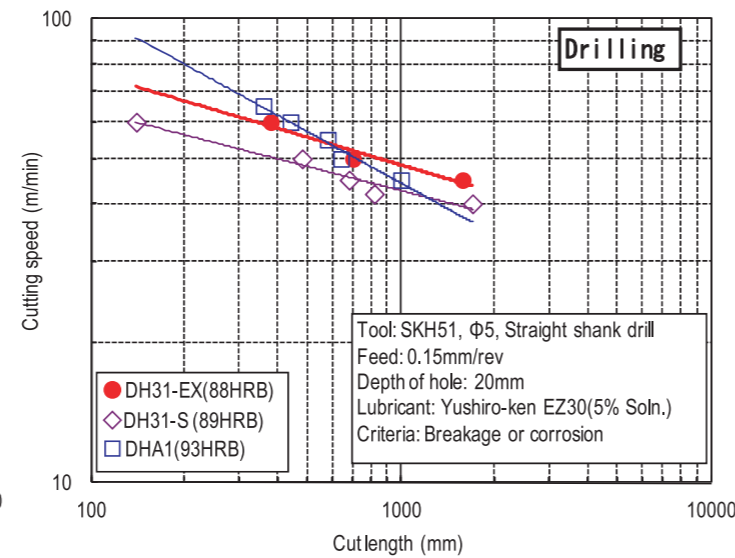
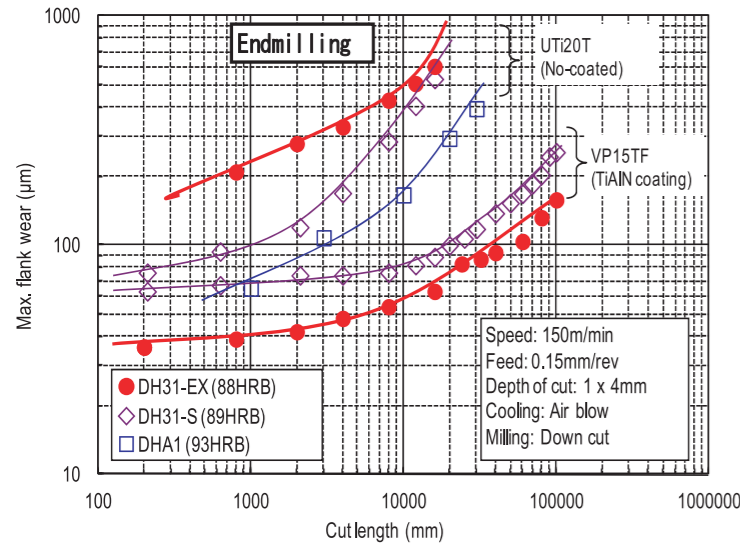


Machinability



Main applications

Applications	Hardness(HRC)
Al, Zn, Mg Diecasting molds	41~48
Hot extrusion dies	43~50
Hot shear blades	35~45
Hot forging dies	42~50

Physical properties

◆ Thermal expansion rate

Temp.	20~100°C	20~200°C	20~300°C	20~400°C	20~500°C	20~600°C	20~700°C
$\times 10^{-6}/K$	11.6	11.8	12.0	12.2	12.5	12.8	12.9

◆ Thermal conductivity

Temp.	100°C	200°C	300°C	400°C	500°C	600°C	700°C
W/m·K	26.7	27.9	29.0	29.4	29.7	30.0	29.5

◆ Specific heat

Temp.	100°C	200°C	300°C	400°C	500°C	600°C	700°C
J/kg·K	487	527	572	626	703	802	985
[cal/g·°C]	[0.116]	[0.126]	[0.137]	[0.150]	[0.168]	[0.192]	[0.235]

※Heat treatment of specimens

Quenching : 1030°C, AC, Tempering : 610°C, AC, Twice

IMPORTANT NOTE

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Daido's Hot Work Die Steel Series

DH31-EX

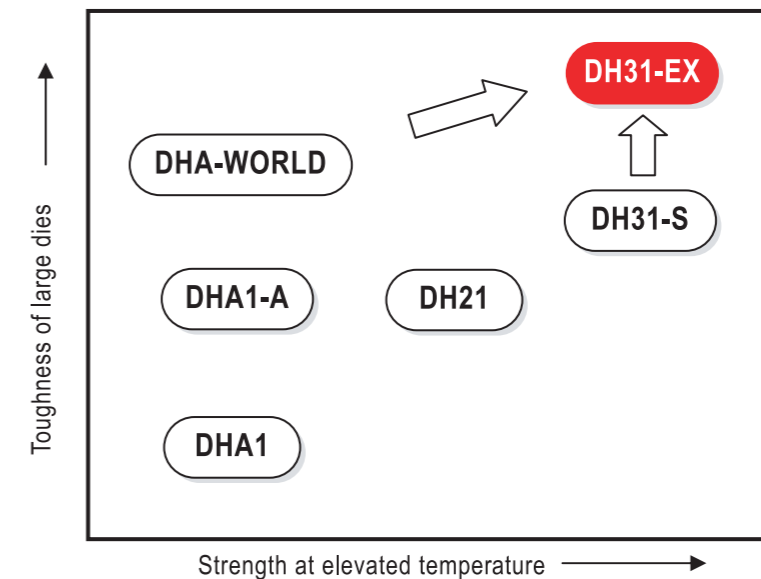


High Performance Hot Work Die Steel

Features

High toughness throughout large Die Casting Dies and Forging Dies contributes to prevent from the risk of gross cracking in service

- ◆ High hardenability ··· High toughness even in large sized Dies
- ◆ High hot strength ··· Great heat checking and wear resistance
- ◆ Double melted ··· Homogeneous and almost isotropic properties throughout Dies



Chemical composition

- Patent pending

Heat treating

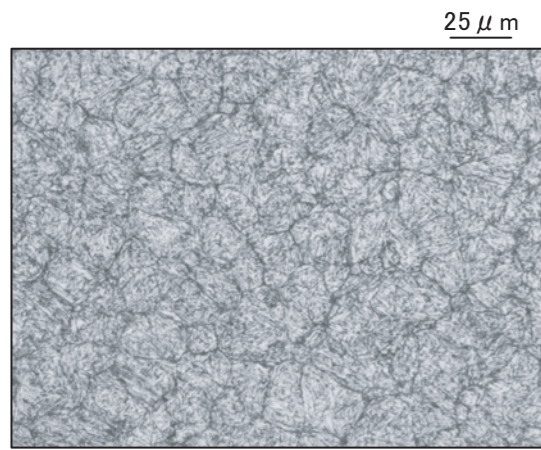
Forging Temperature (°C)	Heat treatment(°C)			Hardness		Transformation Temp.(°C)	
	Annealing	Quenching	Tempering	Annealing	Quenching Tempering	Ac	Ms
900~1200	820~870 Slow cooling	1000~1050 Air cooling	550~650 Air cooling	≤235HB	35~53HRC	805~885	300 (Austenitized at 1030°C)

Properties

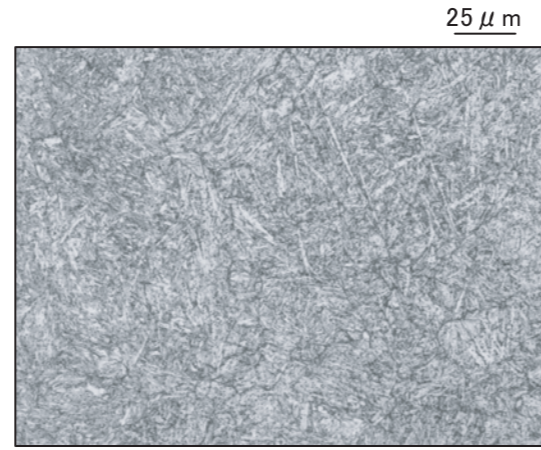
Material size : 200mm H × 800mm W

Microstructure (Quenched and Tempered)

Specimen : 200mmH × 600mmW × 300mmL (Center)
Quenching : 1030°C, Gas quenching with 6-9 bar in vacuum furnace



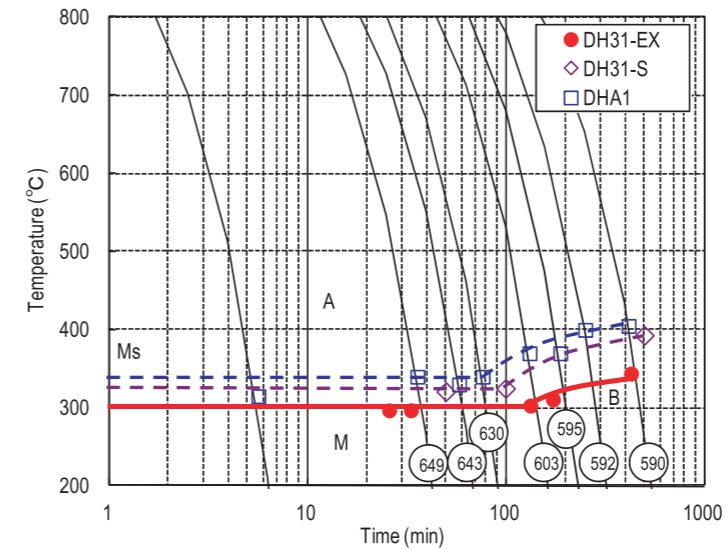
DH31-EX



DHA1

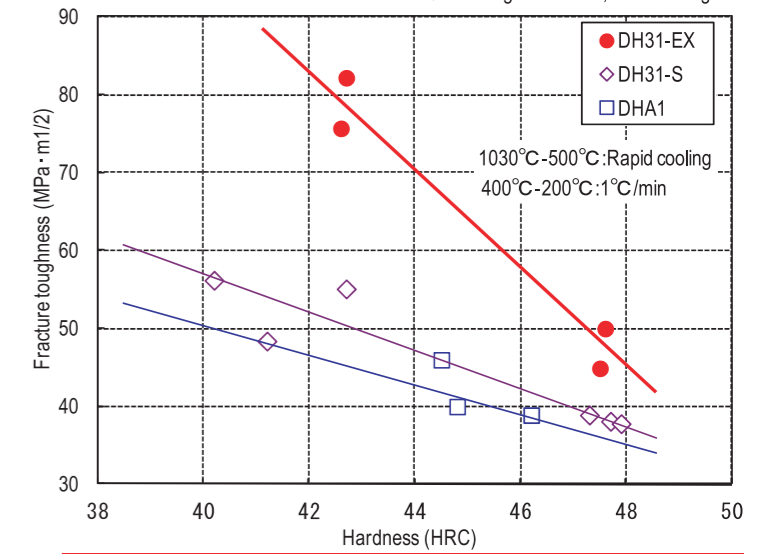
CCT curves

Austenitizing : 1030°C × 15min



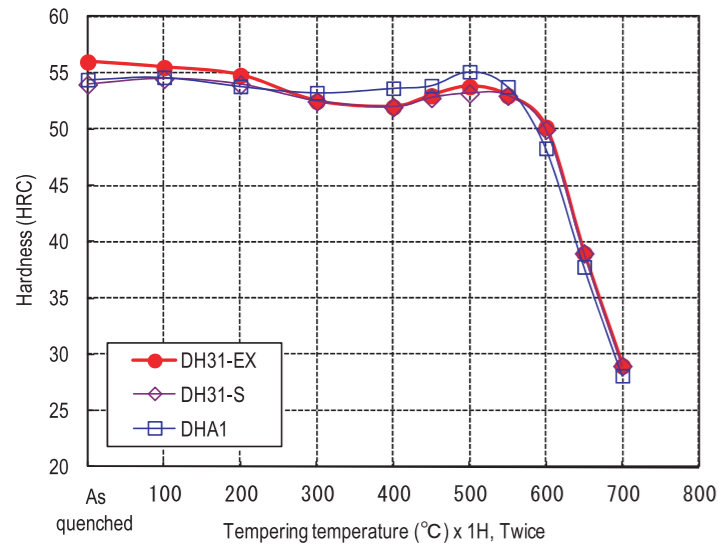
Fracture toughness

Specimen : 12.5mm × 61mm × 64mm
Quenching : 1030°C, Gas cooling



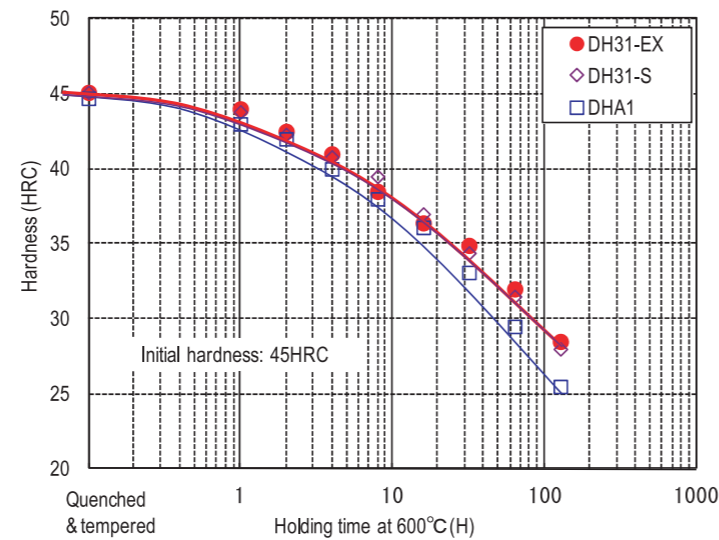
Tempering hardness

Specimen : 10mm × 15mm × 20mm
Quenching : 1030°C × 15min, AC



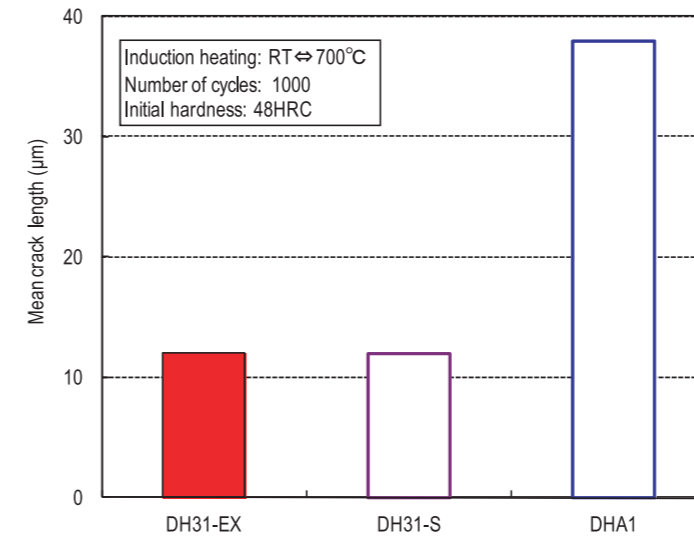
Softening resistance

Specimen : 200mmH × 600mmW × 300mmL (Center)
Quenching : 1030°C, Gas quenching with 6-9bar



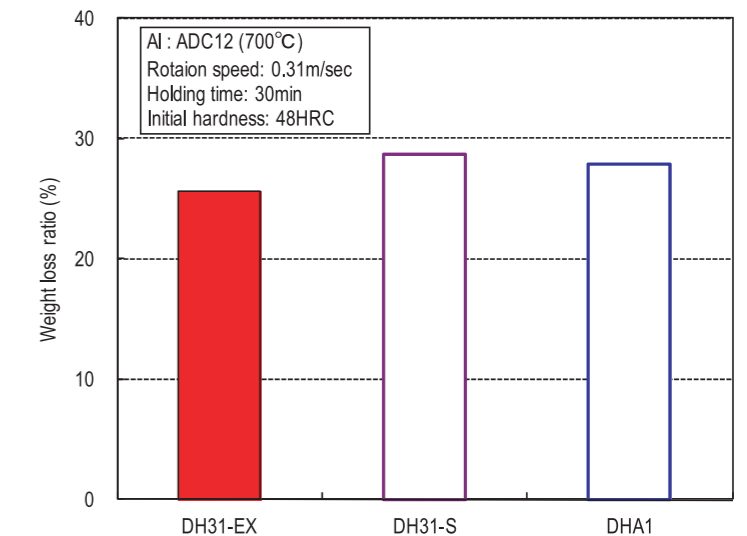
Heat checking resistance

Specimen : φ 15mm. × 5mm
Quenching : 1030°C, Gas cooling



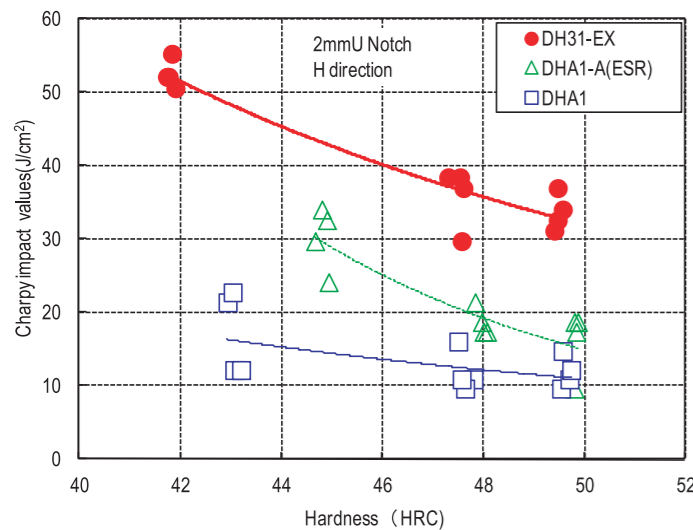
Al erosion resistance

Specimen : φ 10 × 30mm
Quenching : 1030°C, Gas cooling

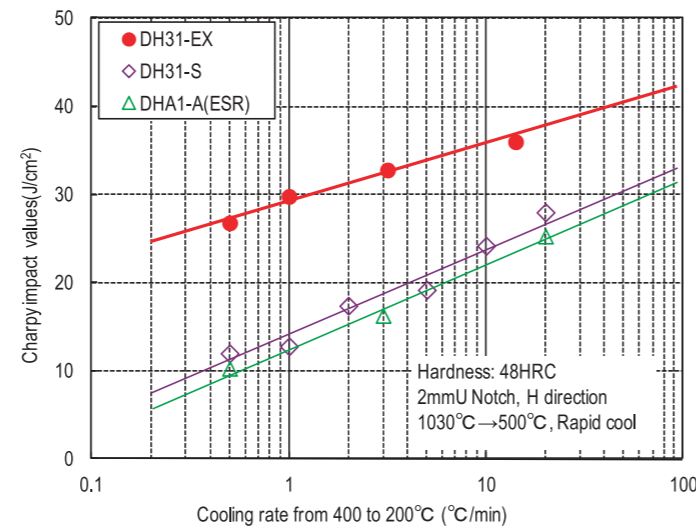


Toughness

Specimen : 200mmH × 600mmW × 300mmL (center)
Quenching : 1030°C, Gas quenching with 6-9bar

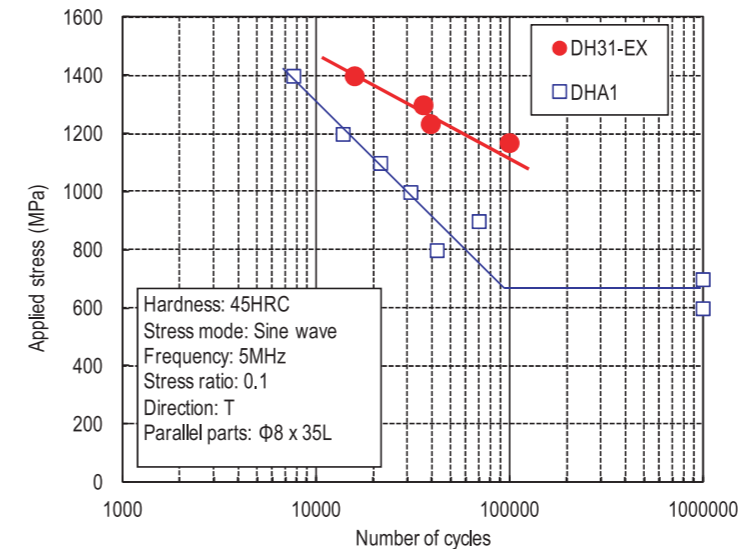


Specimen : 10mmSquare × 55mm
Quenching : 1030°C × 1H, Gas cooling



Fatigue properties

Specimen : φ 26 × 180mm
Quenching : 1030°C, Gas cooling



Nitriding characteristics

Nitriding : PS treatment
Initial hardness : 45HRC

