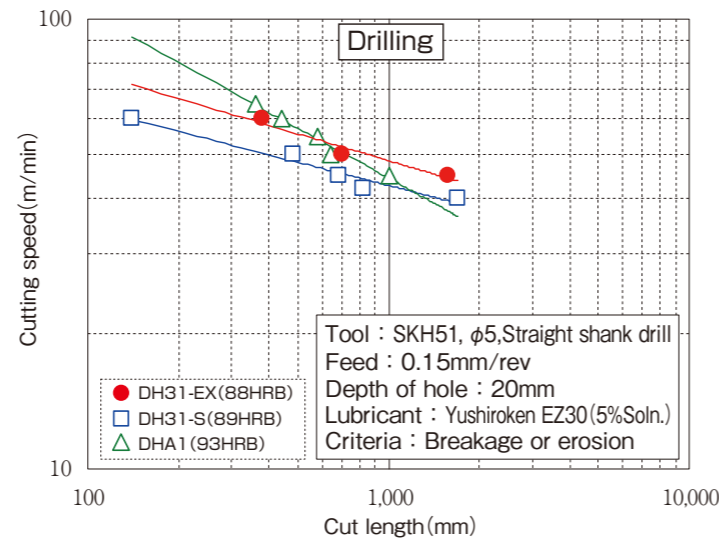
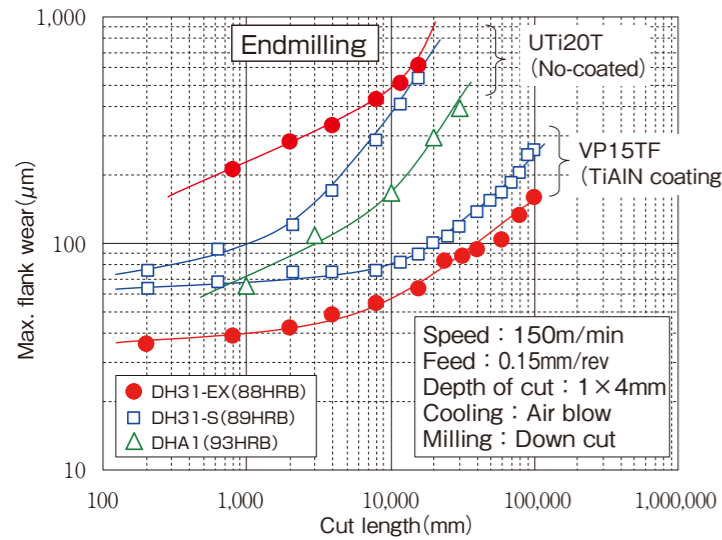


Machinability



Main applications

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

Physical properties

Quenching : 1030°C × 1h, Air cooling
Tempering : 610°C × 1h, Twice
Hardness : 45HRC

◆ Thermal expansion rate

Temp.	20~100°C	20~200°C	20~300°C	20~400°C	20~500°C	20~600°C
× 10 ⁻⁶ /K	11.0	11.4	11.7	12.1	12.5	12.7

◆ Thermal conductivity

Temp.	25°C	100°C	200°C	300°C	400°C	500°C	600°C
W/m·K	27.2	28.4	29.1	29.8	30.1	30.0	29.6

*Accuracy of repeated measurements is about ±10%.

◆ Specific heat

Temp.	25°C	100°C	200°C	300°C	400°C	500°C	600°C
J/kg·K	468	513	557	588	657	712	825

◆ Young's modulus / Rigidity modulus / Poisson's ratio(25°C)

Young's modulus	Rigidity modulus	Poisson's ratio
211GPa	81GPa	0.29



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■ Document Disclaimer

The product characteristics included in this brochure are the representative values based on the result of our measurements, and do not guarantee the performance in use of the products. Please inquire the latest information to our department in charge as the information of this brochure is updated without previous notice as needed.
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No.SC1302c 22.05.0.0 (DDD)

Daido's Hot Work Die Steel Series

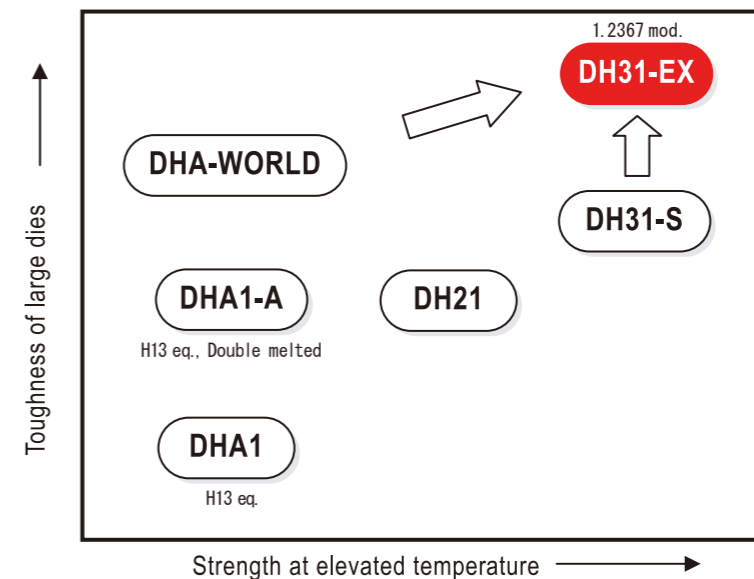
DH31-EX™

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



Heat treatment

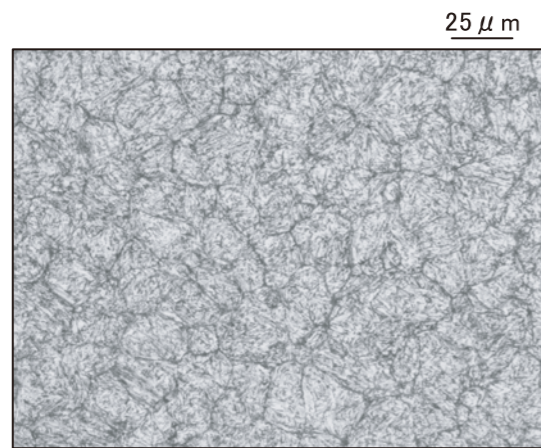
Re-forging Temperature (°C)	Heat treatment(°C)			Hardness		Transformation Temp.(°C)	
	Annealing	Quenching	Tempering	Annealed	Quenched & Tempered	Ac	Ms
900~1200	820~870 Slow cooling	1000~1050 Air cooling	550~650 Air cooling	≤ 235HBW	35~53HRC	805~885	300 (Austenitized at 1030°C)



Properties

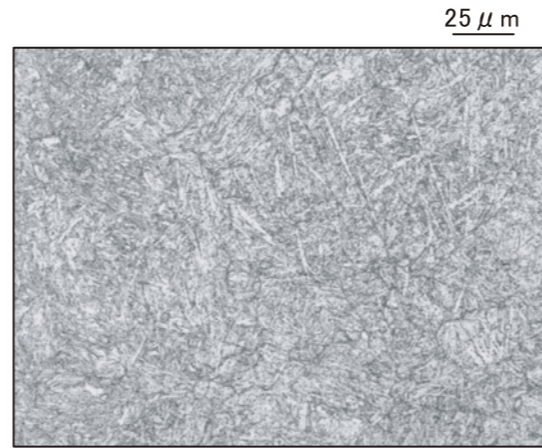
Material size : 200mm H × 800mm W

Microstructure (Quenched and Tempered)



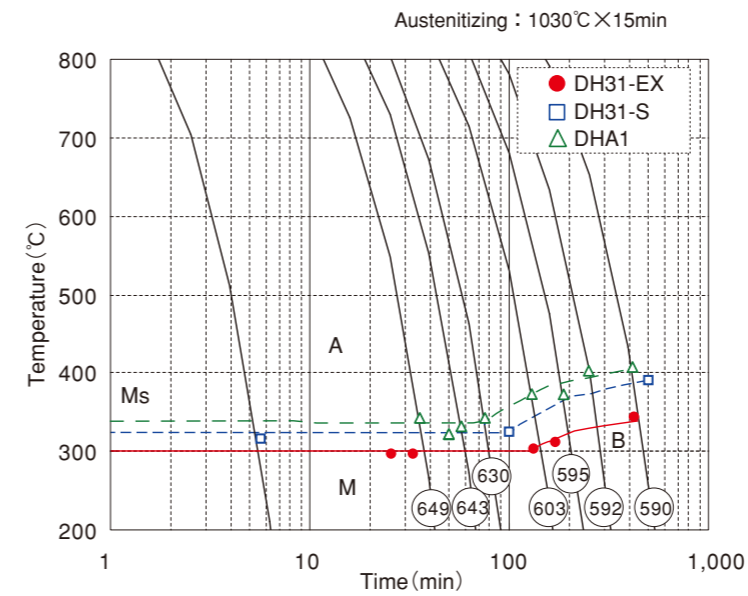
DH31-EX

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

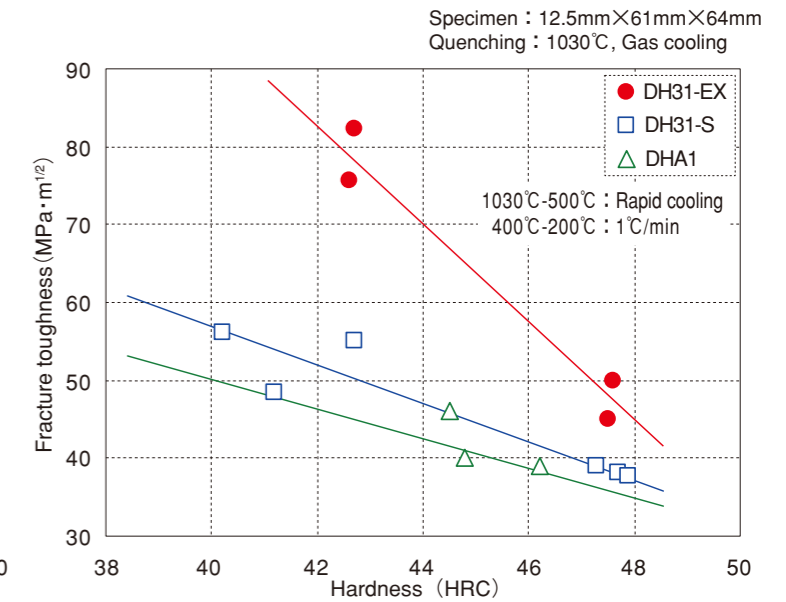


DHA1

CCT diagram

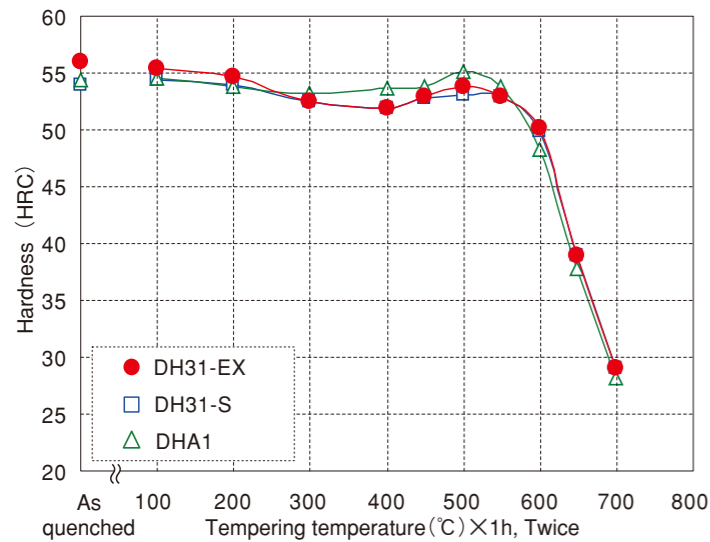


Fracture toughness



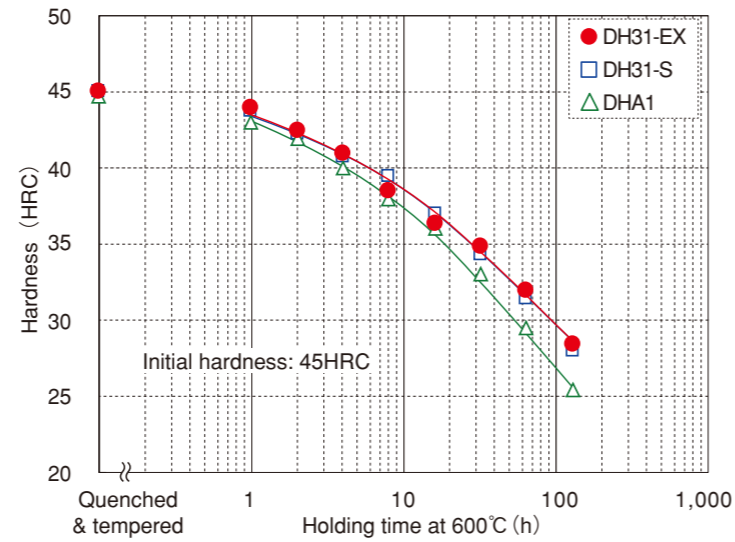
Tempered hardness

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



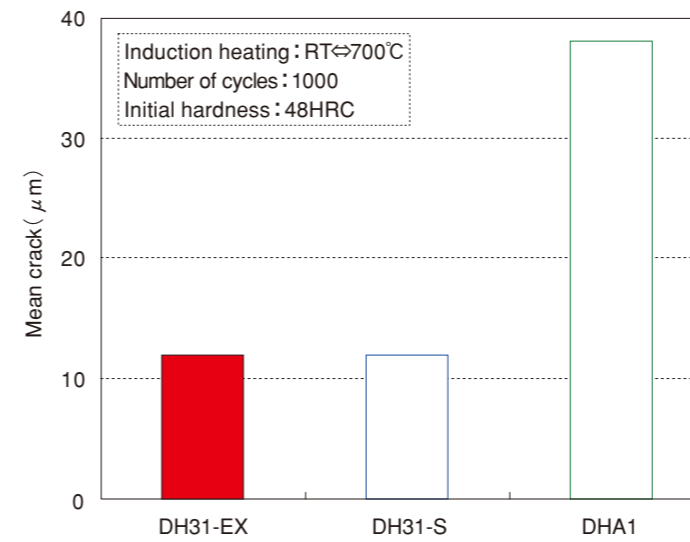
Softening resistance

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



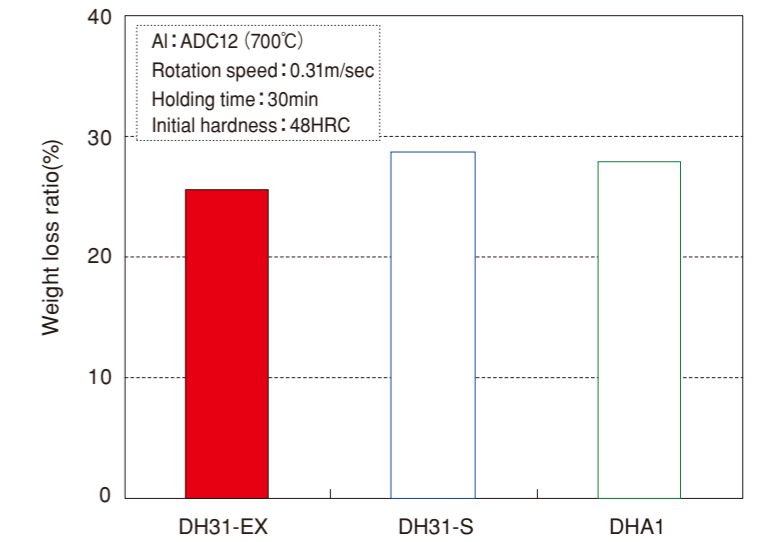
Heat checking resistance

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



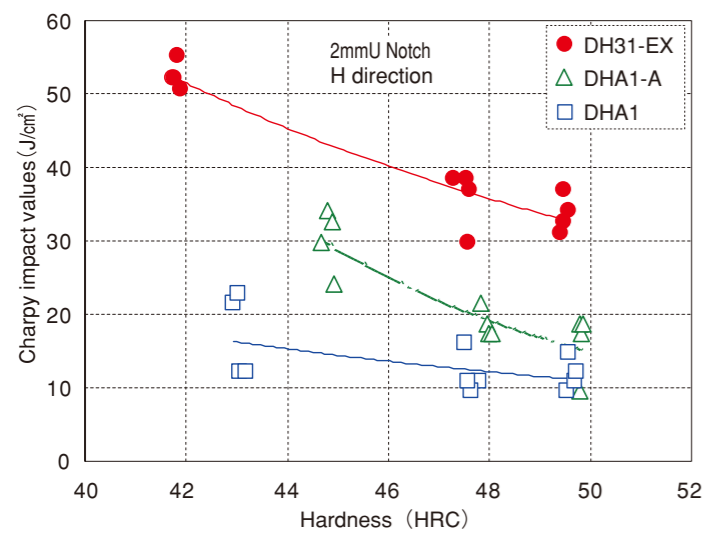
Al erosion resistance

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

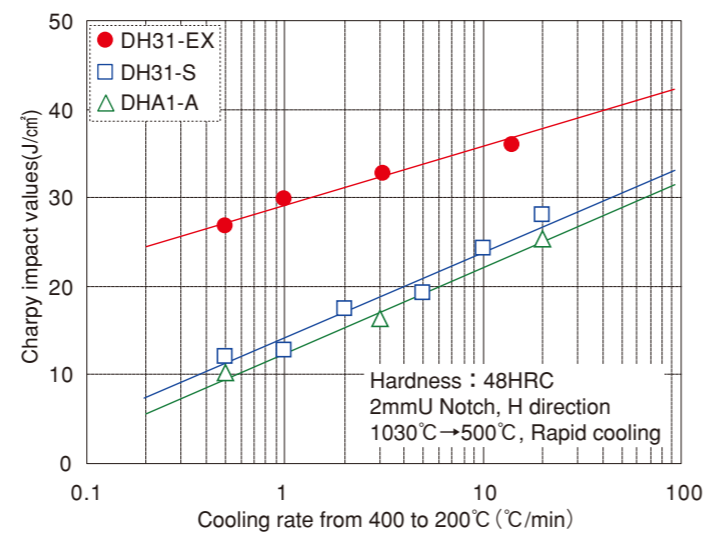


Toughness

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

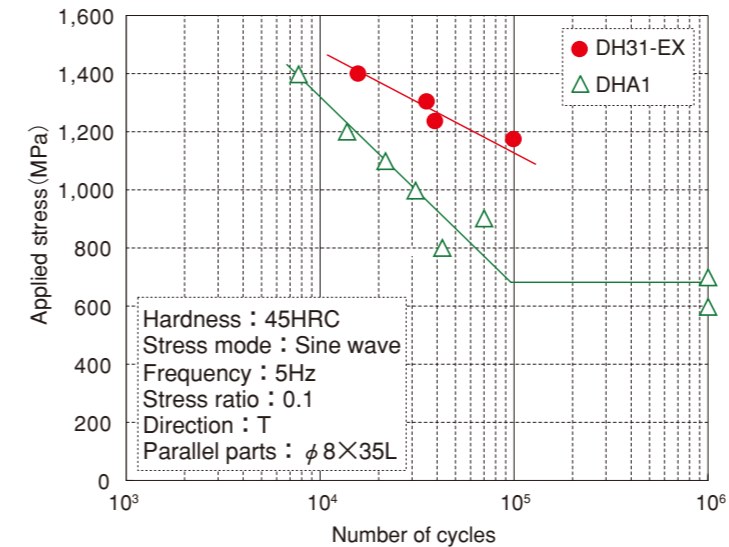


Specimen : 10×10×55mm
Quenching : 1030°C×1h, Gas cooling



Fatigue properties

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



Nitriding characteristics

Nitriding : PS treatment
Initial hardness : 45HRC

