Dream Series

Daido's DRM2

Warm and Cold Forging Die Steel

High hard and tough matrix type high speed tool steel

Features

Matrix type high speed tool steel available for warm and cold forging tools where critical performance is required.
DRM2 prolongs service life due to its higher hardness and toughness than those of conventional grades.

①Applicable with the maximum hardness 62HRC
②Fine microstructure contributes to high toughness and fatigue strength
③Greater hardenability results in high performance even in large dies and gas quenching in vacuum furnace.
④Double melting realizes clean and homogeneous steel with less non-metallic inclusions

Applications

・Warm forging dies and punches
・Cold forging dies and punches

Heat treatment

Re-forging Temperature	Heat treatment conditions (℃)			Hardness	
	Annealing	Quenching	Tempering	Annealed	Hardening / Tempering
Requested to inquire	800～880 Slow cooling	1050～1120 OQ , GC, Salt bath	550～620 AC,≧twice	≦235HB	58～62HRC

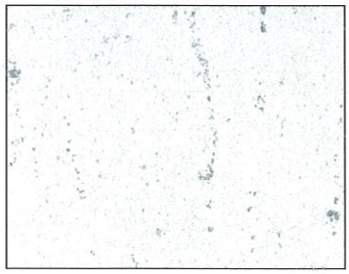
OQ : Oil quenching , GC : Gas quenching in vacuum furnace, AC : Air cooling

Microstructure (As annealed)

●Fine and uniform microstructure with less coarse carbides

DRM2 (Middle of 100 dia. bar)

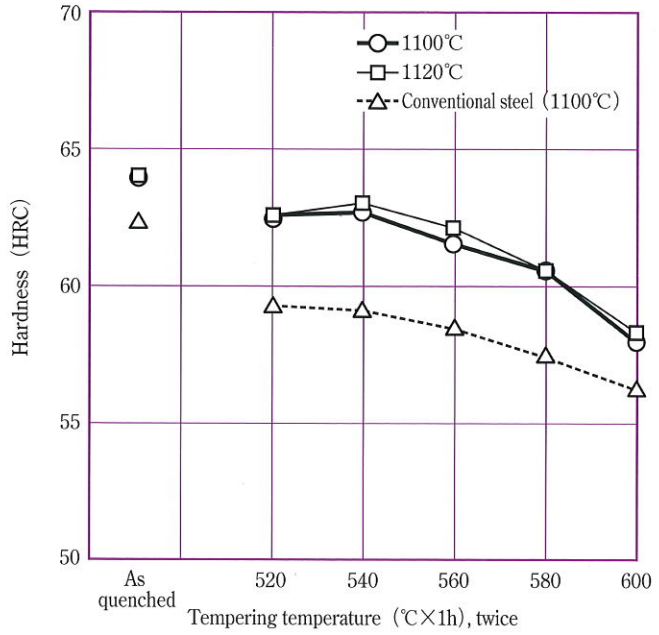
Conventional steel (Daido)



〈Cr_2O_3 Electrically etching〉

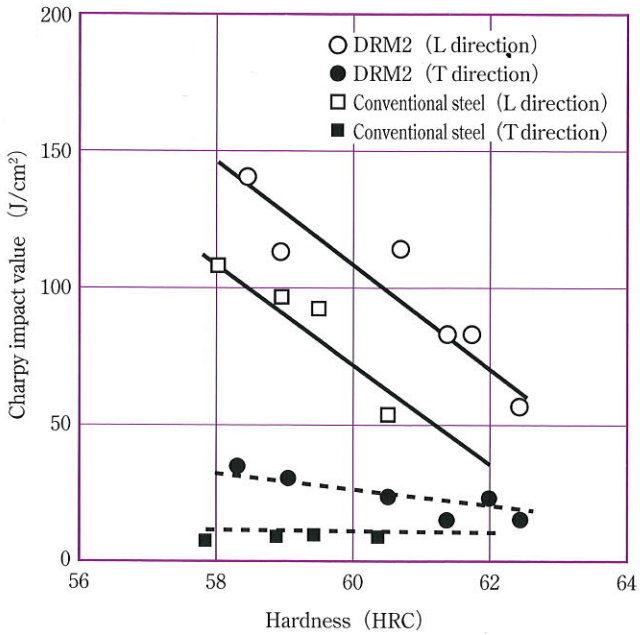
DAIDO STEEL

Tempering hardness



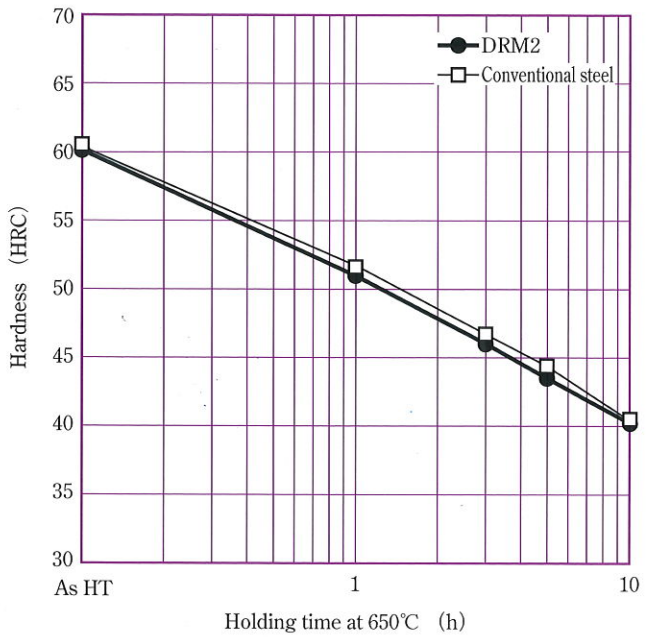
- Specimen : 15mm square
- Hardening : Oil quenching
- Tempering : Air cooling

Toughness : Charpy impact property



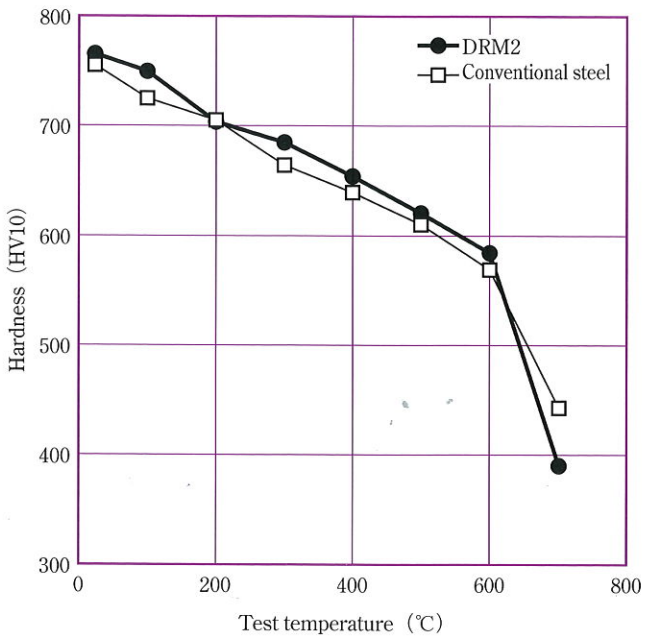
- Sampling : 100mm dia. Bar center
- Specimen : 10R notched
- Heat treatment : DRM2····· H : 1120℃ OQ
  T : 540～600℃ AC, twice
  Conventional Steel ··· H : 1120℃ OQ
  T : 540～600℃ AC, twice

Temper softening resistance



- Heat treatment : DRM2····· H : 1120℃ OQ
  T : 580℃ AC, twice
  Conventional Steel ··· H : 1120℃ OQ
  T : 610℃ AC, twice

Hot hardness



- Heat treatment : DRM2····· H : 1120℃ OQ
  T : 560℃ AC, twice
  Conventional Steel ··· H : 1120℃ OQ
  T : 560℃ AC, twice

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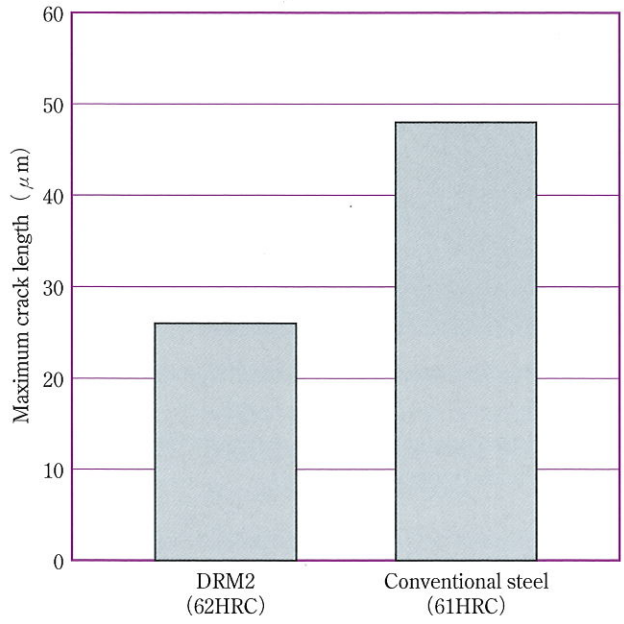
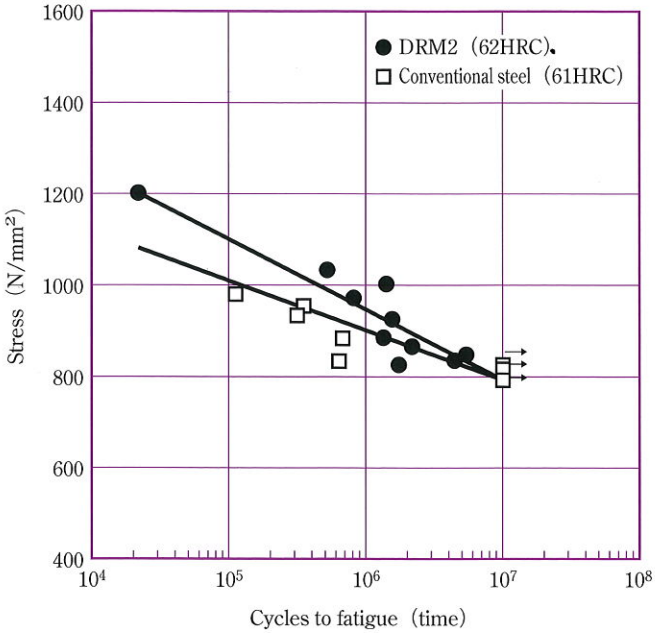
Heat checking resistance



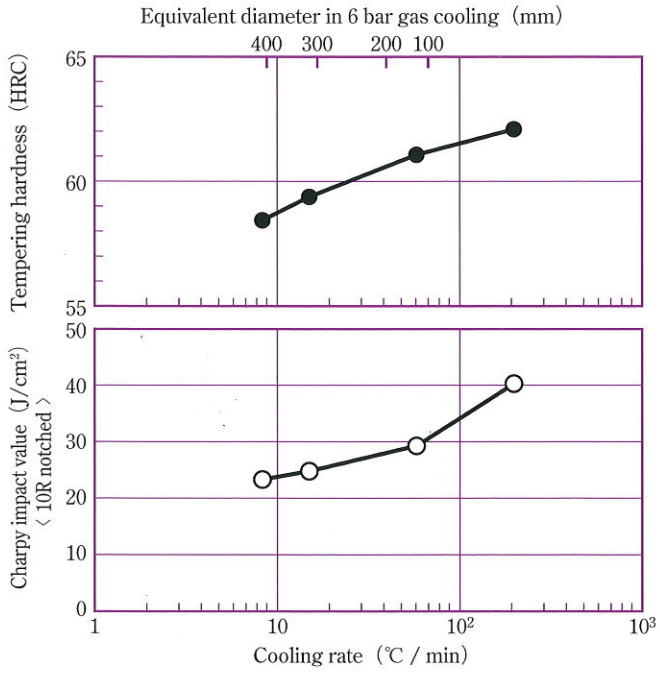
●Specimen : 15 mm dia.10 mm thick
●Heat treatment : DRM2····· H : 1120℃ OQ
T : 560℃ AC, twice
Conventional Steel ··· H : 1140℃ OQ
T : 560℃ AC, twice
●Test method : Induction heating 20←→ 700℃ (1000 times)

Fatigue strength



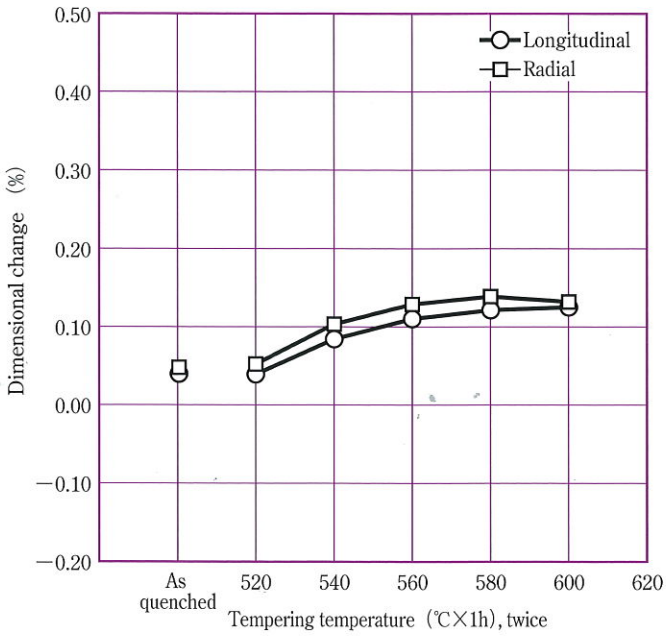
●Sampling : 100 mm dia. Bar center
●Heat treatment : DRM2····· H : 1120℃ OQ
T : 560℃ AC, twice
Conventional Steel ··· H : 1140℃ OQ
T : 560℃ AC, twice
●Test method : Rotating bending fatigue test (20℃)

Hardenability



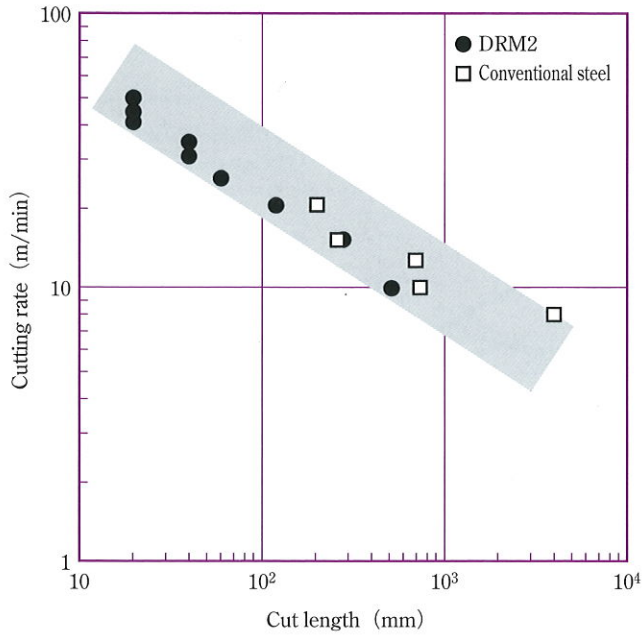
●Sampling : 100mm dia. Bar center
●Heat treatment : H : 1120℃ (200℃ / min → equal to OQ)
T : 560℃ AC, twice

Dimensional changes in heat treatment



●Specimen : 36mm dia. × 60 mm
●Hardening : 1120℃ salt bath quenching

Drilling machinability



●Specimen : As annealed
●Tool : NACHI SD ϕ 5mm (non-coated)
●Test condition · Feed : 0.15mm/rev · Hole depth : 20mm
· Cutting fluid : none

Physical Properties

◆Coefficient of expansion

	20~100℃	20~200℃	20~300℃	20~400℃	20~500℃	20~600℃	20~700℃	20~800℃
$\times 10^{-6}$/K	11.0	11.4	11.8	12.1	12.3	12.6	12.4	12.9

◆Thermal conductivity

	25℃	200℃	300℃	400℃	500℃	600℃	700℃
W/m·K [cal/cm·sec·℃]	23.2 [0.055]	26.9 [0.064]	27.9 [0.067]	29.0 [0.069]	28.8 [0.069]	29.2 [0.070]	29.6 [0.071]

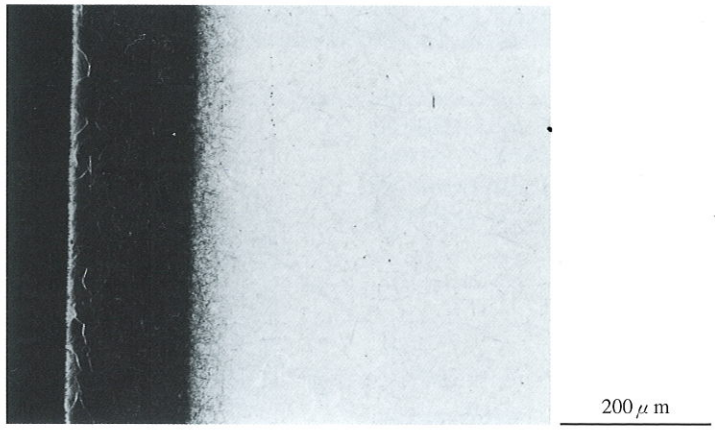
◆Specific heat

	25℃	200℃	300℃	400℃	500℃	600℃	700℃
J/kg·K [cal/g·℃]	458 [0.109]	518 [0.124]	555 [0.133]	598 [0.143]	659 [0.158]	756 [0.181]	910 [0.217]

◆Young's modulus 210 Gpa

· Specimen condition : H : 1120℃ OQ T : 560℃ AC twice

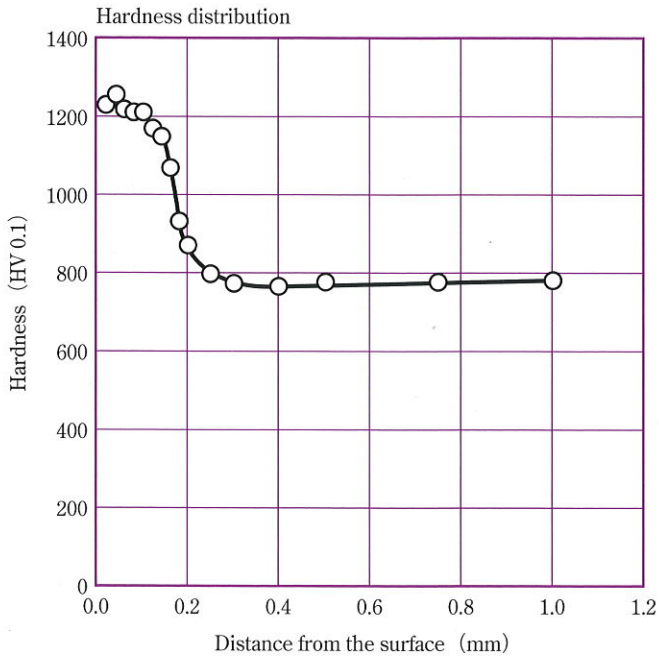
Nitriding



An example of micro structure nitrided by PS process

●PS process

· Daido Amistar's originally developed process featured by high scuffing and errosion resistance



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