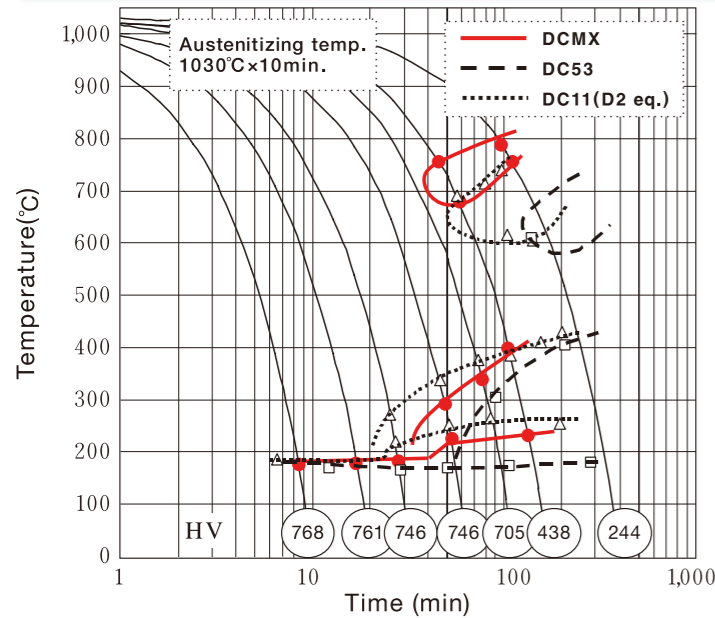


CCT diagrams



Physical properties

Quenching: 1030°C×1h, Gas cooling
Tempering: 520°C×1h, Twice
Hardness: 61HRC

◆ Thermal expansion rate

Temp.	20~100°C	20~200°C	20~300°C	20~400°C	20~500°C	20~600°C
$\times 10^{-6}/K$	10.7	11.4	12.0	12.0	13.0	13.3

◆ Thermal conductivity

Temp.	25°C	100°C	200°C	300°C	400°C	500°C	600°C
W/m·K	16.0	17.1	18.0	19.8	21.7	22.4	24.5

*Accuracy of repeated measurements is about $\pm 10\%$.

◆ Specific heat

Temp.	25°C	100°C	200°C	300°C	400°C	500°C	600°C
J/kg·K	450	456	474	524	587	636	740

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

Young's modulus	Rigidity modulus	Poisson's ratio
204GPa	78GPa	0.30

Comparison of properties among Daido cold work die steels

Properties		DCMX	DC53	DC11(D2 eq.)
Tempering hardness	Low temp.(200°C)	61HRC	61HRC	61HRC
	High temp.(500°C)	62HRC	60HRC	58HRC
	High temp.(520°C)	60HRC	63HRC	58HRC
Isotropy		◎	○	△
Dimensional change with time*1		○(○)	△(○)	○(○)
Hardenability		○	◎	○
Toughness		◎	○	△
Fatigue properties		◎	○	△
Machinability		◎	○	△
Wear resistance		◎	◎	○
Wear resistance to sand		△	○	◎
Wire EDM *2		○	◎	○
Low temp. coating *2		○	◎	○

*1 Comparison by dimensional change when stabilizing treated △:Average, ○:Good, ◎:Excellent
Highlighted is especially featured properties

*2 Comparison by the decrease in hardness when tempered at 520°C for wire EDM and PVD coating



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Daido's Matrix type Tool Steels Series

DCMX™

Matrix type Cold Work Die Steel

Features

DC-Matrix is a matrix type cold work tool steel: only fine carbides are distributed in matrix due to optimum alloy design and production process.
DC-Matrix shows high performance in service and ease in mold making as well.

<Die performance>

- ◆ **High hardness** such as 62HRC is available by high temperature tempering with good dimensional stability, resulting in high wear resistance.
- ◆ **High toughness** contributes to prevent cracking and chipping.

<Ease in die making>

- ◆ **Isotropic** dimensional change works easy geometry control in heat treating.
- ◆ **Machinability** is improved by free machining additives and finely dispersed carbides.

Main applications

- ◆ **Punches, dies and working tools for cold pressing and cold forging, especially for cold stamping dies for high strength steels where galling and peel off of coated layer, TD and CVD, are main failure modes**
Insert blocks for composite stamping dies where good dimensional stability is required in dies alignment
Blanking punches and trimming edges where main failures are cracking and chipping.

Heat treatment

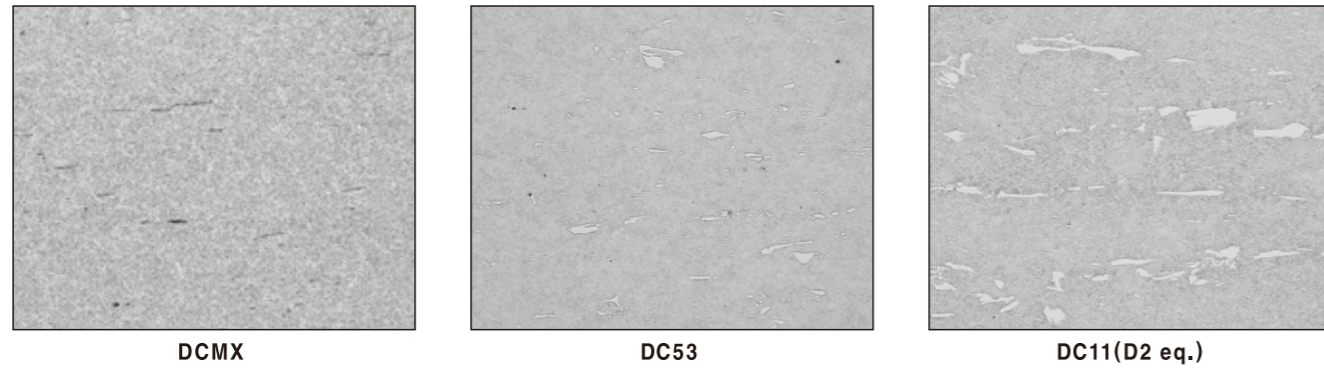
Re-forging Temperature (°C)	Heat treatment (°C)				Hardness	
	Annealing	Quenching	Tempering	Stabilizing treatment	Annealed	Quenched & Tempered
900~1160	920~980 Slow cooling	1000~1050 Air cooling	Low : 150~200 High: 480~560 Air cooling More than twice	400°C for longer than 1h	≤235HBW	56~62HRC



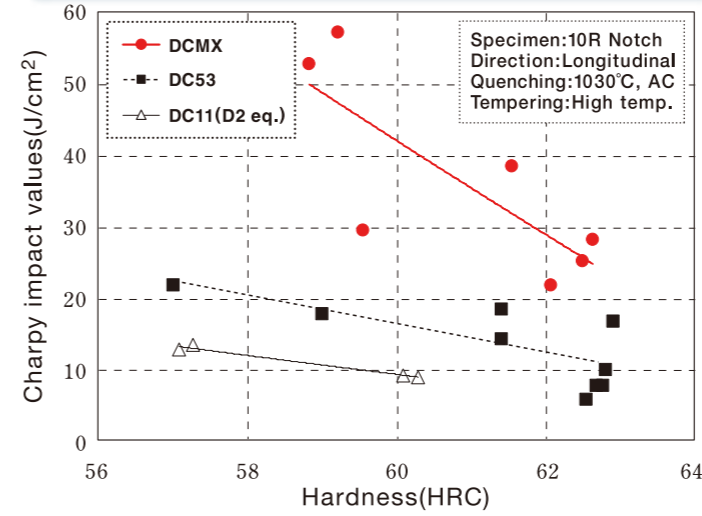
Properties

Optical micrographs(as annealed)

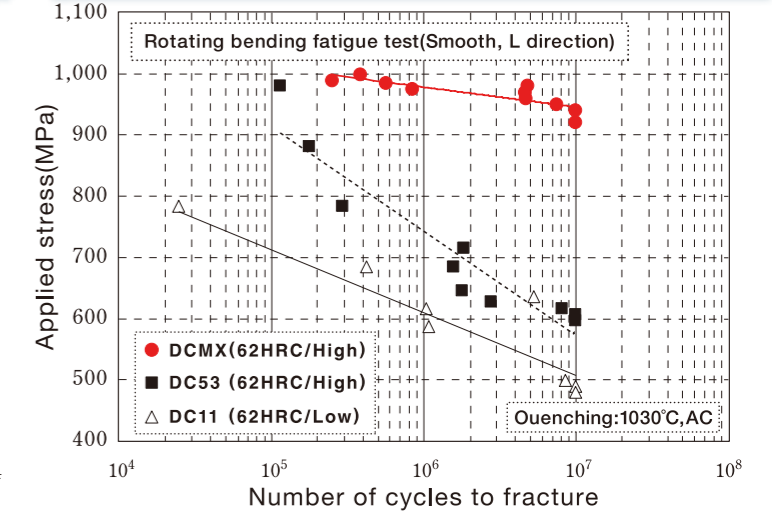
● DCMX shows fine microstructure almost free from coarse carbides



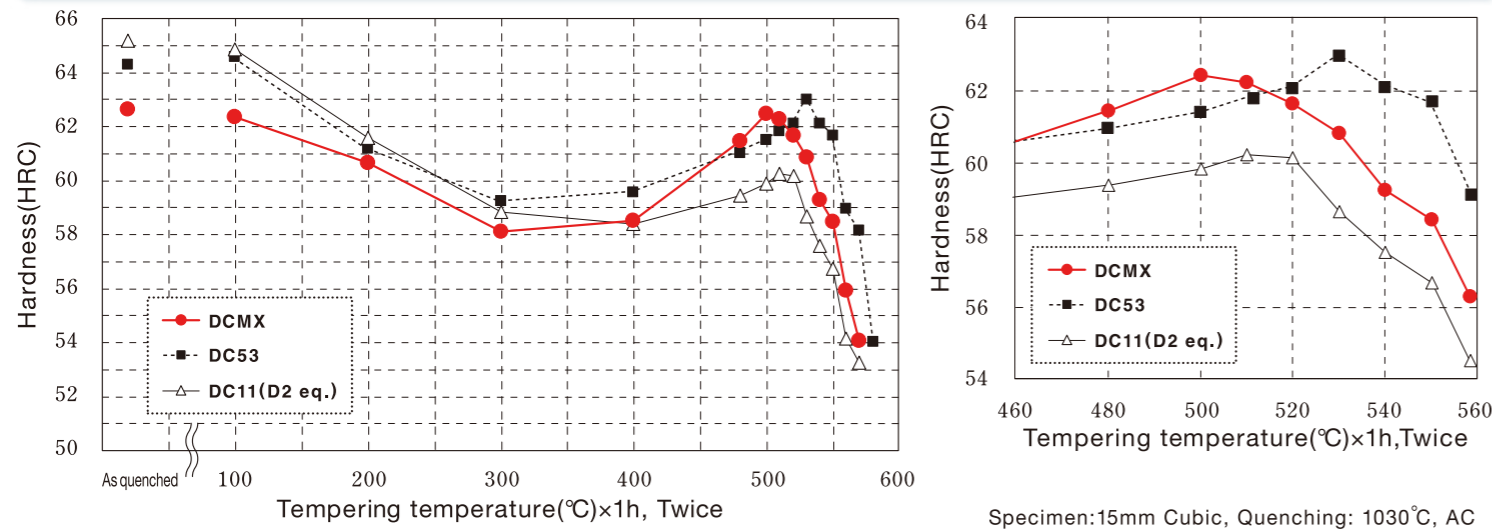
Toughness



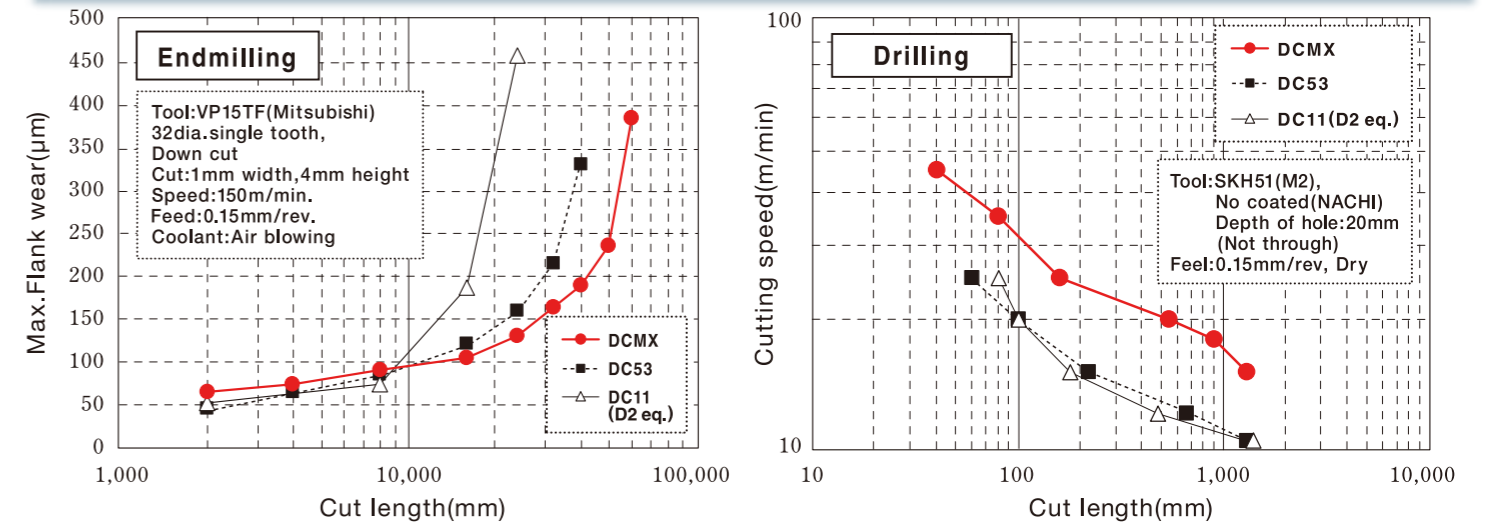
Fatigue properties



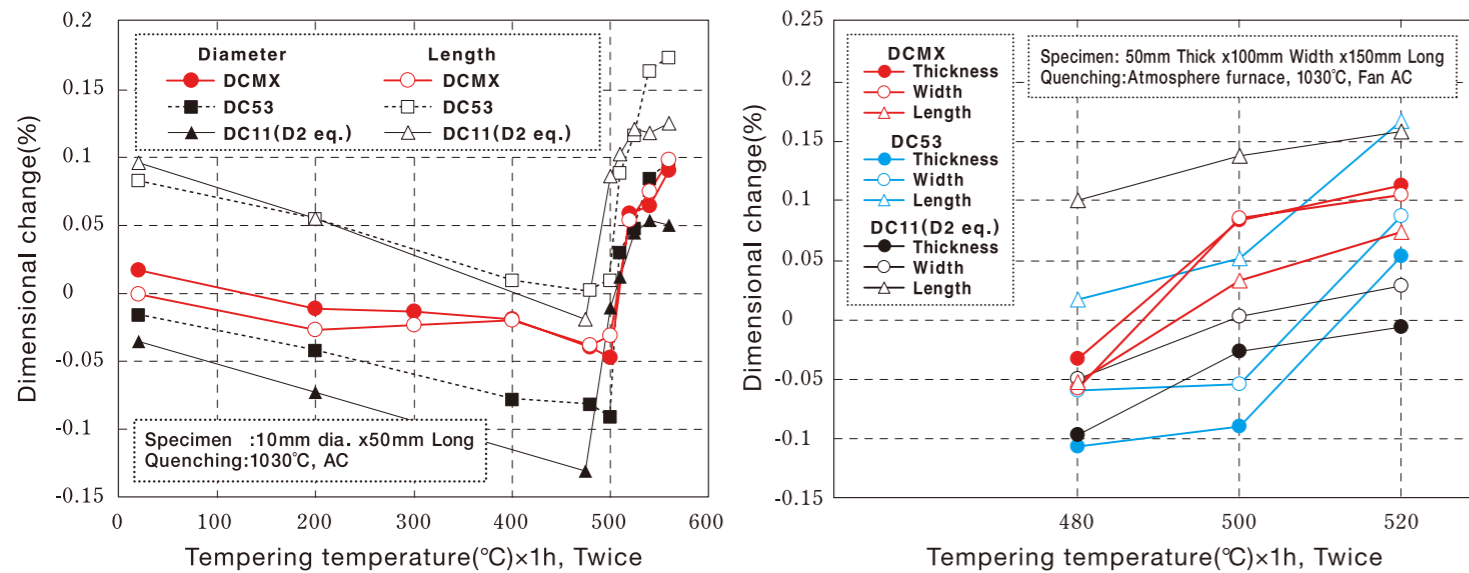
Tempering hardness



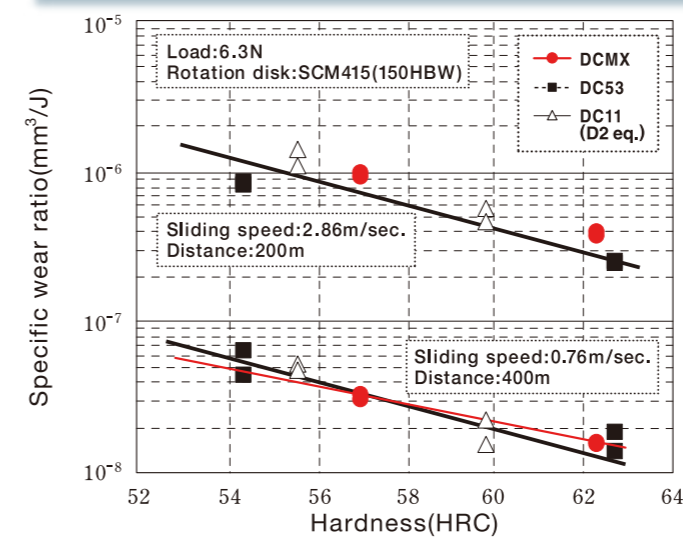
Machinability (annealed)



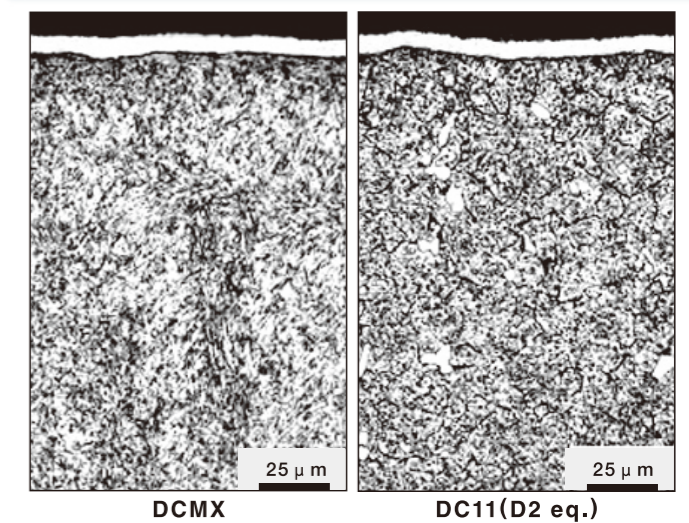
Dimensional stability



Wear resistance (Ohkoshi-test)



TD coating



TD coating: By courtesy of DOWA Thermo Engineering.