High-toughness and wear-resistant matrix cold work steel for cutting and forming high-strength sheets, as well as machine blades.

DCMX® offers outstanding properties for cutting and forming. As a matrix cold work steel, it combines high hardness for excellent wear resistance with high toughness to prevent cracking or chipping. Additionally, DCMX® provides excellent resistance to friction wear and the risk of coating delamination.

Its isotropic behavior during heat treatment ensures unique shape and dimensional stability in all spatial directions. This is especially important for progressive compound tools and fine cutting tools.

Machinability has been further improved compared to common 8% chrome steels, as this special alloy forms finely distributed carbides. With suitable heat treatment tailored to the specific application, you can optimize tool life. In many cases, DCMX® is a more cost-effective alternative to expensive PM steels. DCMX® is also available in thick forged dimensions.

DCMX® is a patented trademark product from the Japanese manufacturer Daido Steel. Gebr. Recknagel distributes DCMX® as the exclusive stock-keeping distributor for Central Europe

Color coding:

black/grey (DCMX)

Daido DCMX

Patented material from Daido Steel Co., Ltd.

Daido DCMX™

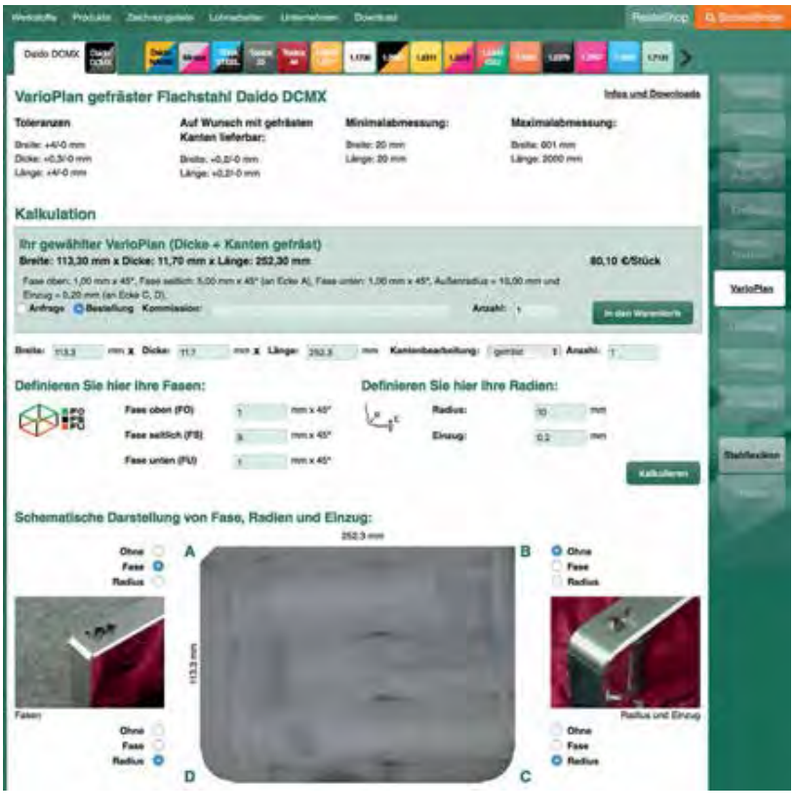
DAIDO STEEL, JAPAN

VarioPlan®

Precision-machined semi-finished products in freely selectable dimensions.

- Flexible in width, thickness, and length
- Edges sawed or milled
- Optionally with chamfers and/or corner radii
- Production in 2 to 3 days
- Easy calculation

Use our online calculation tool on our webshop: **www.varioplan.de**



DCMX

VarioRond®
Round material sections with selectable length, priced per piece.

Execution and Tolerances:

Length, sawn: +3.0 / -0 mm Diameter:

Rolled surface:

36–60 mm +1.0 / -0 mm

61–165 mm +2% / -1% of diameter

Peeled/turned surface:

80–105 mm +1.0 / -0mm

106–450 mm +2.0 / -0mm

diameter range: 36–450 mm

Flexible online calculation:
www.variorond.de

- Desired length is freely selectable
- Unit prices for your desired length
- Sawing costs included
- No additional surcharges

DCMX

Raw material Rolled or forged bars and cuttings thereof

	thickness [mm]														
	13.5	16.5	22.4	27.7	32.7	45	55	65	85	95	110	145	165	185	315

- We cut cuttings according to your specifications
- Available as pre-processed VarioPlan®
- Flat steel bars are available for immediate delivery
- Round materials are available as VarioRond®

Choose affordable raw materials online, including custom cutting.
www.ResteShop.de

Fast, clear, and transparent:
Offcut shop and Quick finder at www.stahlnetz.de

Offcut shop

- All materials
- With cutting service
- Available from stock
- Affordable special prices for offcuts
- While supplies last

Quick finder

- All products in comparison
- Your custom parts pre-calculated
- Easy selection of the optimal solution

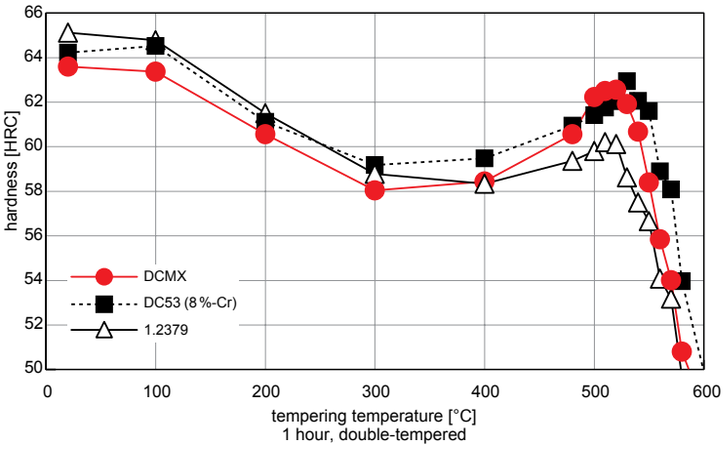
DCMX

Daido DCMX™

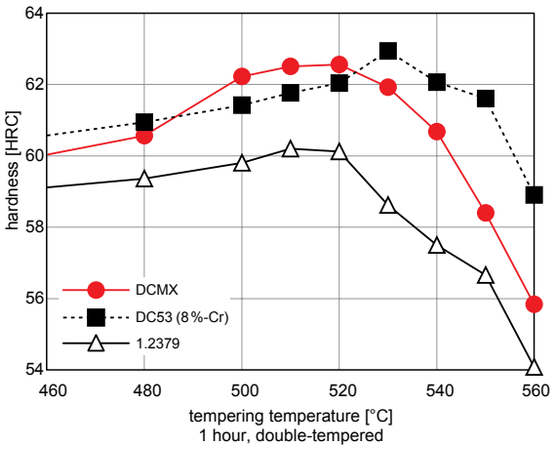
chemical composition [%]

	C	Si	Mn	Cr	Mo	V
comp. ref. analysis%	0.7	2.0	1.0	6.8	1.4	0.2

Tempering treatment



Sample: 15mm, cubic
hardening at 1030°C, gas quenching



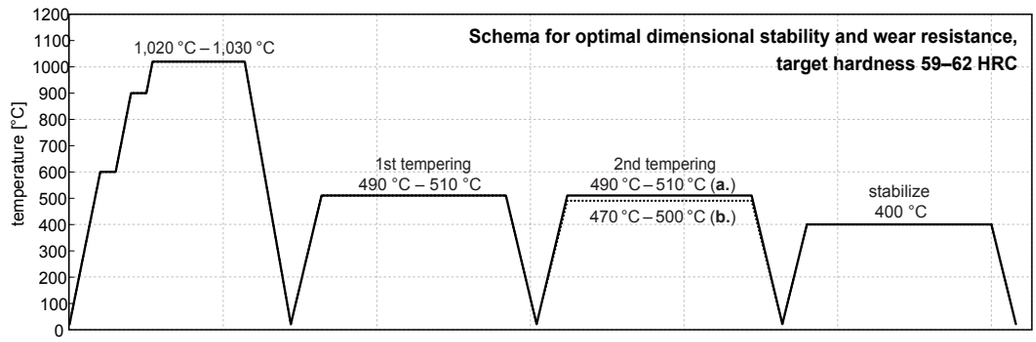
High-strength steels are increasingly being used in automobiles to reduce weight. This presents special requirements for tool steels in terms of chipping, cracking, abrasive and friction wear. Cost efficiency and secure tool manufacturing processes are in demand. An optimized balance between hardness and toughness, as well as good machinability, is of particular importance. Previously, dimensional stability and predictability in heat treatment and continuous operation were unresolved challenges. The newly developed DCMX cold work matrix steel by our technology partner Daido from Japan shows exceptional potential in this regard.

Daido DCMX™

chemical composition [%]

	C	Si	Mn	Cr	Mo	V
comp. ref. analysis%	0.7	2.0	1.0	6.8	1.4	0.2

Heat treatment

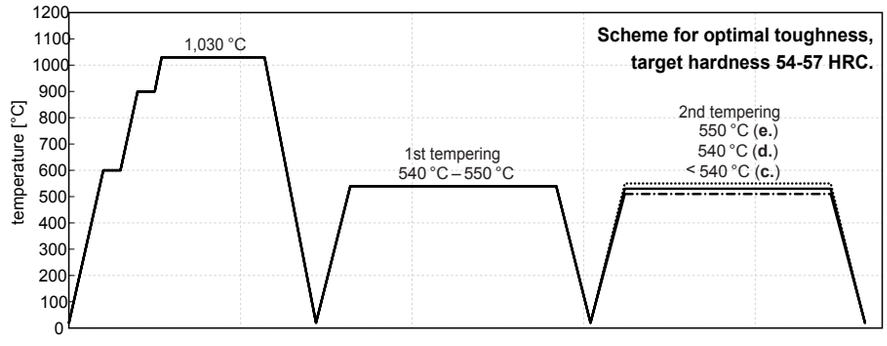


Checking hardness after the initial tempering, if:

a. Hardness is too high
=> Second tempering at the same temperature

b. Hardness is as desired
=> Second tempering 10–20°C lower

Followed by stabilizing at 400°C for one hour.



Checking hardness after the initial tempering, if:

c. Target hardness achieved
=> Second tempering below 540° C

d. Hardness is 1-2 HRC too high
=> Second tempering at 540°C

e. Hardness is 3 HRC or more too high
=> Second tempering at 550°C

DCMX

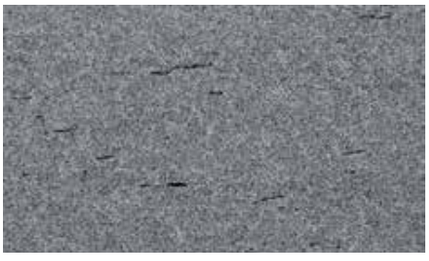
chemical composition [%]

	C	Si	Mn	Cr	Mo	V
comp. ref. analysis%	0.7	2.0	1.0	6.8	1.4	0.2

treatment temperatures					hardness	
hot forming	anealing	hardening	tempering	stabilizing	anealed	hardened
900 – 1,160 °C	920 – 980 °C slow furnance cooling	1.000 – 1.050 °C cooling air or gas	low: 150 – 200 °C high: 480 – 560 °C min. 2x	400 °C for min. 1 h	≤ 235 HB	56 – 62 HRC

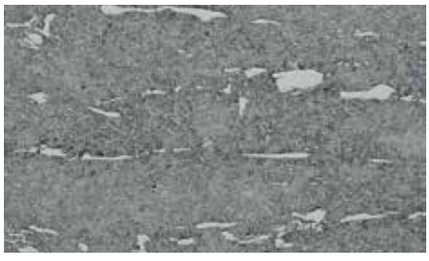
Microstructure

Daido DCMX® exhibits an exceptionally fine microstructure, nearly devoid of coarse primary carbides



DCMX®

Daido-DC53 (8%-Cr-steel)



1.2379

Conventional steels exhibit elongated primary carbides, and the difference in volume change during hardening in the longitudinal and transverse directions is caused by this; a high carbide content intensifies the effect. DCMX® was developed to address this issue. Here, primary carbides are significantly reduced. In other words, a matrix cold work steel was developed that has very few large primary carbides. This results in not only optimal dimensional stability but also significantly improved toughness and machinability.

Daido DCMX™

chemical composition [%]

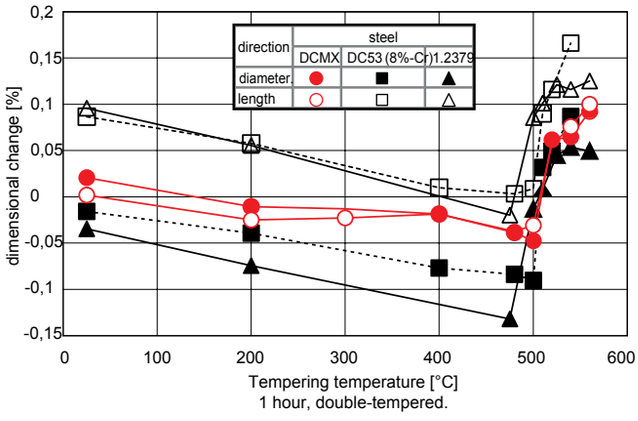
	C	Si	Mn	Cr	Mo	V
comp. ref. analysis%	0.7	2,.0	1.0	6.8	1.4	0.2

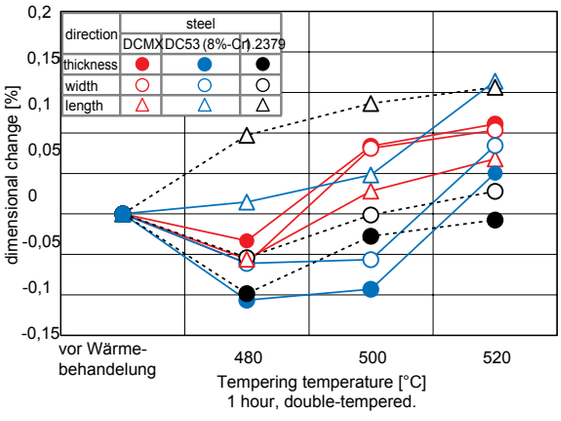
Today, larger punching and bending tools are being segmented to address the well-known issues related to dimensional changes during hardening. Common steels like 1.2379 / X 153 CrMoV 12 and previously known 8% Cr tool steels exhibit anisotropic behavior during hardening in the three spatial directions. Extensive post-processing and dividing functional parts into smaller segments become necessary.

The smallest difference in terms of dimensional changes in the spatial directions is observed at the highest hardness of 62 HRC achieved by tempering at 500°C. Dimensional changes over time are a known phenomenon at high tempering temperatures. A stabilization treatment at 400°C after tempering effectively mitigates this issue.

Shape and dimensional stability (isotropic behavior).

hardening: in an open atmosphere, 1030°C, oil quenching.





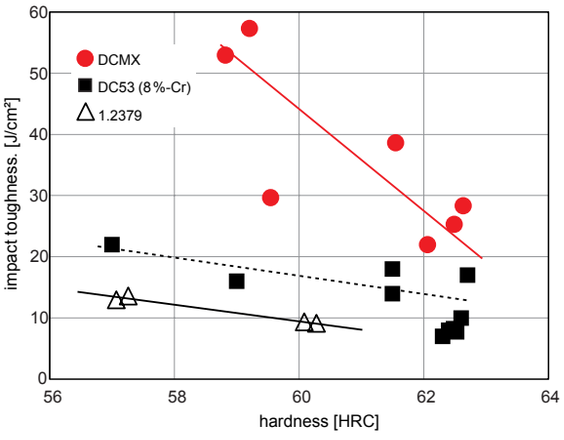
Daido DCMX™

chemical composition [%]

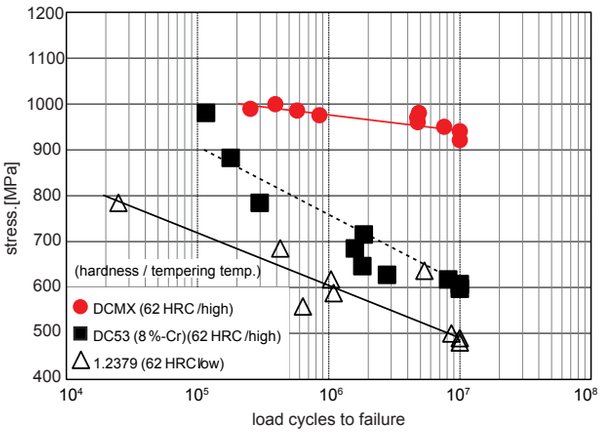
	C	Si	Mn	Cr	Mo	V
comp. ref. analysis%	0.7	2.0	1.0	6.8	1.4	0.2

DCMX exhibits high impact toughness, not only in comparison to 1.2379 / X 153 CrMoV 12 but even compared to 8% Cr steels like DC53 or TENASTEEL™ This results in significantly less susceptibility to chipping or cracking. The fatigue properties are also outstanding.

Impact toughness
U-notch specimen, R=1mm, longitudinal direction, hardening at 1,030°C, high tempering temperature.



Fatigue strength/material fatigue
Wöhler test (longitudinal direction), hardening at 1,030°C, gas quenching.



DCMX

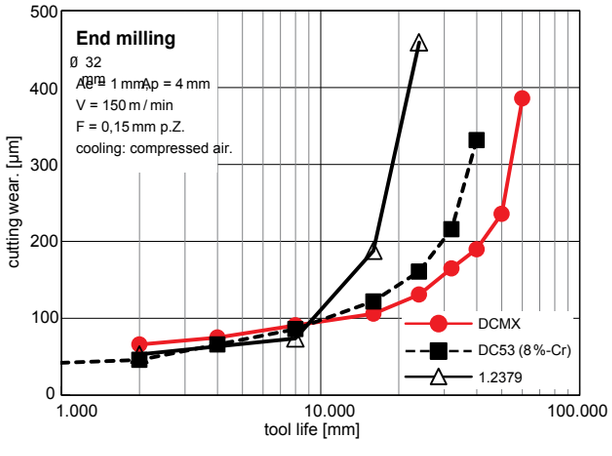
Daido DCMX™

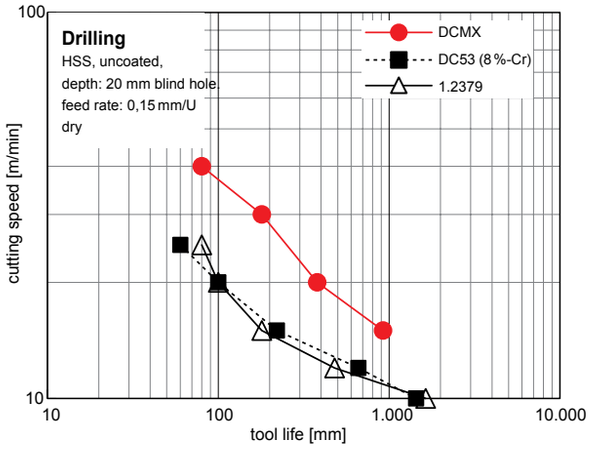
chemical composition [%]

	C	Si	Mn	Cr	Mo	V
comp. ref. analysis%	0.7	2.0	1.0	6.8	1.4	0.2

Both in the unhardened and, especially, in the hardened state, the machinability is exceptionally good, leading to longer tool life or the possibility of faster machining.

Machinability in comparison (in the annealed state).



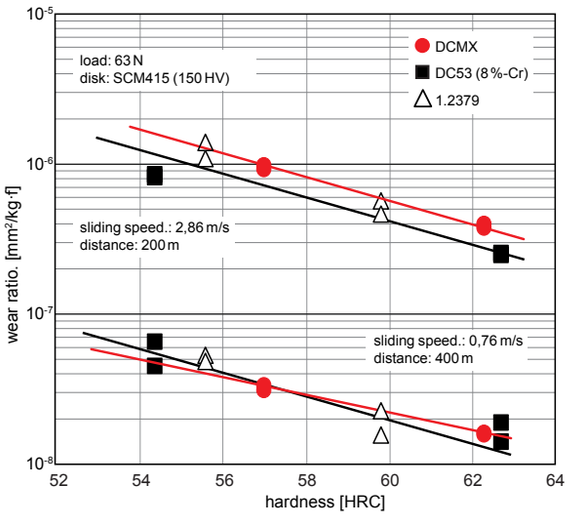


DCMX

chemical composition [%]

	C	Si	Mn	Cr	Mo	V
comp. ref. analysis%	0.7	2.0	1.0	6.8	1.4	0.2

Wear resistance (pin-on-disk test)



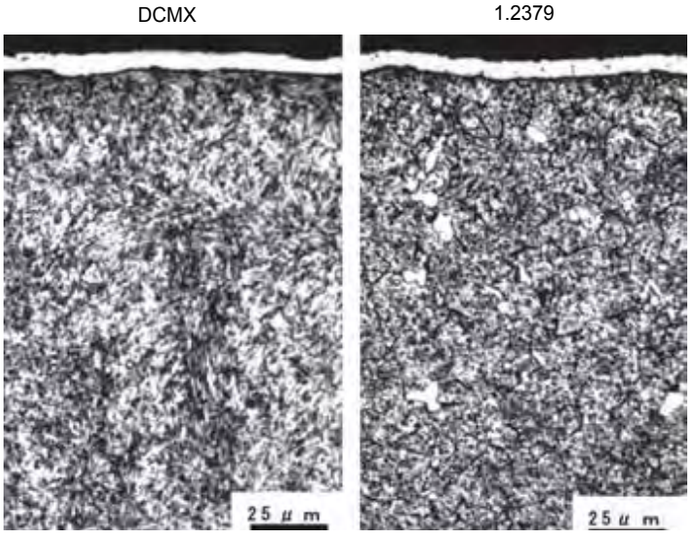
Wear resistance is a critical criterion for steel selection. It is essential to differentiate between various wear forms to make an appropriate choice. Adhesive wear, such as that occurring in bending and deep-drawing operations, can be assessed using the pin-on-disk test. Here, it is evident that hardness plays a crucial role in wear behavior. Even at 62 HRC, DCMX™ demonstrates outstanding toughness, setting this new material apart from the conventional options. Abrasive wear can be evaluated using the friction wheel-sand test. Although DCMX™, with its very fine carbide distribution, lacks large primary carbides, this material performs quite well in comparison. Both test methods indicate that DCMX™ is an optimally balanced material for enhancing tool life.

Daido DCMX™

chemical composition [%]

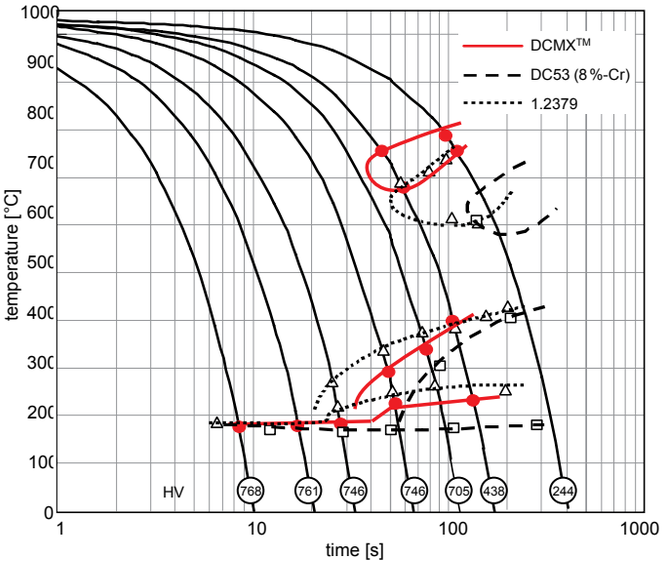
	C	Si	Mn	Cr	Mo	V
comp. ref. analysis%	0.7	2.0	1.0	6.8	1.4	0.2

Coating
Thermoreactive diffusion layer: DOWA Thermo Engineering.



In Japan, more and more punching and bending tools are being PVD-coated to optimize tool life. DCMX™ is excellently suited for this purpose. It offers very good adhesion, partly due to its higher base hardness compared to 1.2379 / X 153 CrMoV 12.

Time-Temperature-Transformation (TTT) diagram
hardening at 1,030°C for 10 minutes.



DCMX

chemical composition [%]

	C	Si	Mn	Cr	Mo	V
comp. ref. analysis%	0,7	2,0	1,0	6,8	1,4	0,2

Physical properties

thermal expansion coefficient [10⁻⁶/K]						
20 – 100 °C	20 – 200 °C	20 – 300 °C	20 – 400 °C	20 – 500 °C	20 – 600 °C	20 – 700 °C
13.3	13.7	14.0	14.4	14.7	14.9	14.9

thermal conductivity [W/mK]					
RT	100 °C	200 °C	300 °C	400 °C	500 °C
17.1	18.8	20.9	22.6	24.0	25.7

specific heat [J/kgK]					
RT	100 °C	200 °C	300 °C	400 °C	500 °C
507	535	570	611	654	719

Young's modulus = 202 GPa, specific weight = 7.67 kg/dm3,
sample hardened at 1,030 °C, air-cooled, double-tempered at 500 °C

In certain cases, repair welding becomes necessary. DCMX™ offers relatively favorable conditions for this purpose. Preheating at 350°C and post-weld heat treatment at 400°C result in a uniform hardness distribution and protection against weld cracks. DCMX™ is successfully used for larger automotive-type tools. Customers appreciate the predictability and reliability of dimensional stability and, in particular, the often significantly longer tool life.

In summary, a matrix cold work steel that focuses on reducing primary carbides combines three advantages: nearly complete avoidance of problems related to dimensional changes during hardening, significantly improved machinability, and high toughness and fracture resistance.

(Summarized translation of a technical article by Takayuki Shimizu, Koichiro Inoue, Atsushi Sekiya from "Denki-Seiko (Electric Furnace Steel), Issue 81 (2010), No. 1, pages 53 ff.)

The provided values are always representative technical data based on our investigations. Unless otherwise indicated, they do not constitute guarantees. Please seek individual advice as needed.

Daido DCMX™

chemical composition [%]

	C	Si	Mn	Cr	Mo	V
comp. ref. analysis%	0.7	2.0	1.0	6.8	1.4	0.2

Material comparison

property		DCMX™	Daido-8-%-Cr-steel	1.2379
tempering-temperature	low (200 °C)	61 HRC	61 HRC	61 HRC
	high (500 °C)	62 HRC	60 HRC	58 HRC
	high (520 °C)	60 HRC	62 HRC	58 HRC
Isotropy		◎	○	△
Volume change over time *1		○(○)	△(○)	○(○)
hardenability		○	◎	○
toughness		◎	○	△
material fatigue		◎	○	△
machinability		◎	○	△
wear resistance (abrasive wear)		◎	◎	○
abrasive wear resistance		△	○	◎
wire erosion *2		○	◎	○
PVD coating *2		○	◎	○

*1 Comparison of volume change in the stabilized state.: △ : average, ○ : good, ◎ : excellent

*2 Comparison of the hardness loss due to tempering at 520°C for electrical discharge machining (EDM) and PVD coating.

DCMX