

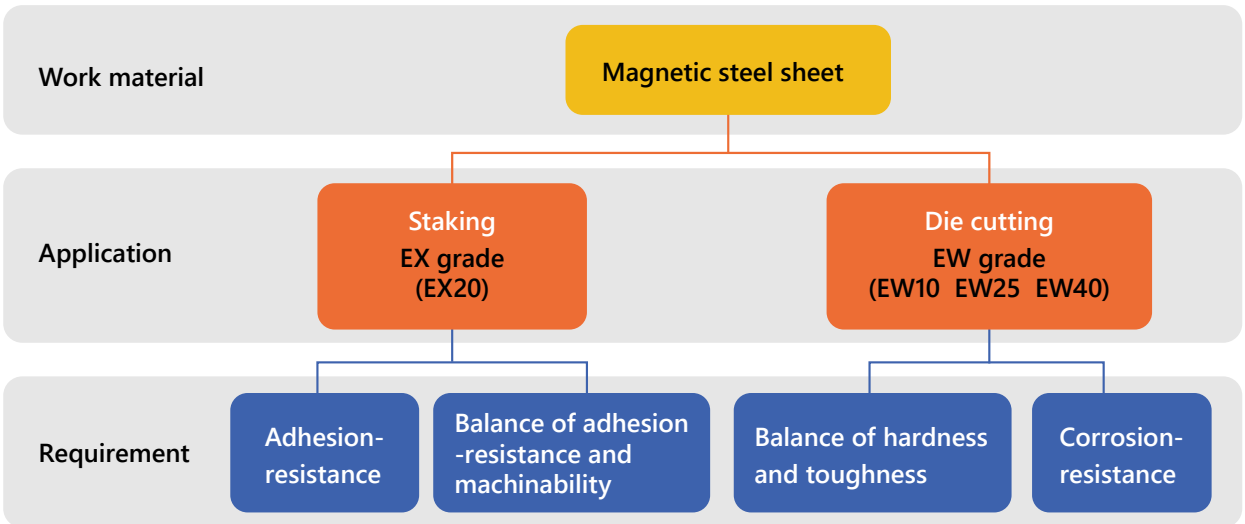
## Cemented carbide for magnetic steel sheet - EX grade, EW grade

### Lineup which has an excellent performance on processing magnetic steel sheet

EX grade is for magnetic steel sheet staking, which is well suited for adhesion resistance.

EW grade is for magnetic steel sheet die cutting, which is well suited for hardness, toughness and corrosion resistance.

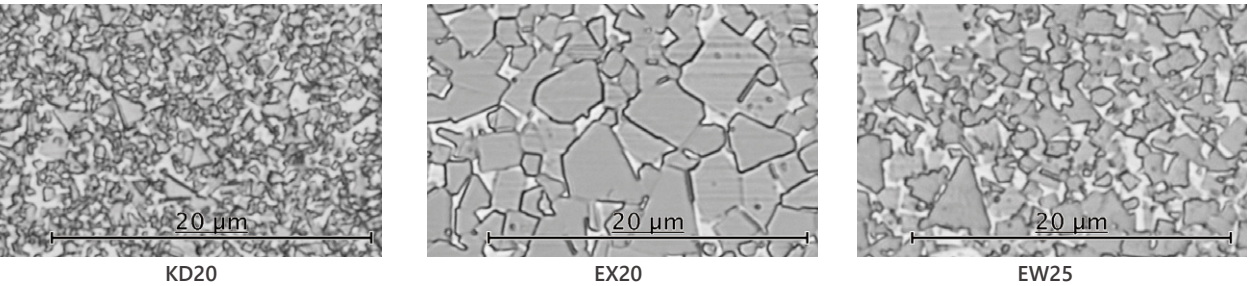
### Criterion for selecting grades for processing magnetic steel sheet



### Physical property

Our grade	TAS classification	WC grain size [μm]	Co content [%]	Hardness HRA	TRS [GPa]	Fracture toughness value [MPa · m <sup>1/2</sup> ]	Thermal expansion coefficient [×10 <sup>-6</sup> /K]	Thermal conductivity [W/(m · K)]
KD20	VF-40	1.0(less than)	13	90.0	3.7	16	5.6	71
EX20	VC-40	2.5 - 5.0	6	90.0	3.7	19	4.7	80
EW25	VM-40	1.0 - 2.5	11	89.5	3.5	22	5.4	73

### Micrographs



By metallurgical microscope (×1000)

## Cemented carbide for magnetic steel sheet staking - EX grade

### High hardness, toughness and corrosion-resistant cemented carbide

Mold life expansion by special composition design, which improves adhesive wear.

Explanation	Grade which has excellent adhesion resistance in staking magnetic steel sheet.
Applications	1. For punch and die staking magnetic steel sheet. 2. For resistance of adhesion wear. 3. In case that chipping and defect are caused by adhesion wear. 4. Resistance against the damage caused by WEDM, corrosion and others to improve the above 2 and 3 features.

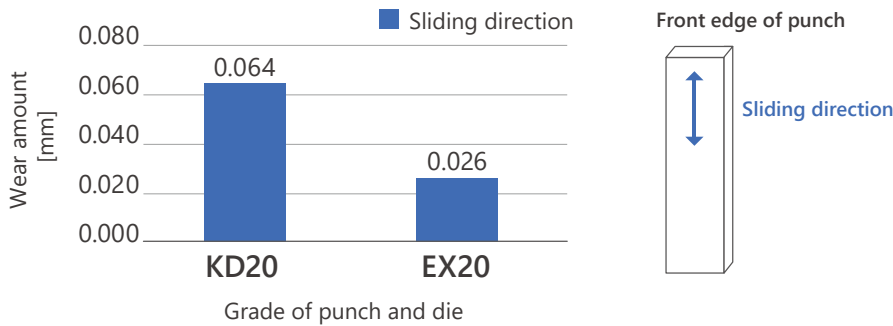
### Physical property of EX20

Our grade	Hardness HRA	TRS [GPa]	Fracture toughness value [MPa · m <sup>1/2</sup> ]	Density [×10 <sup>3</sup> kg/m <sup>3</sup> {g/cm <sup>3</sup> }]
EX20	90.0	3.7	19	14.9

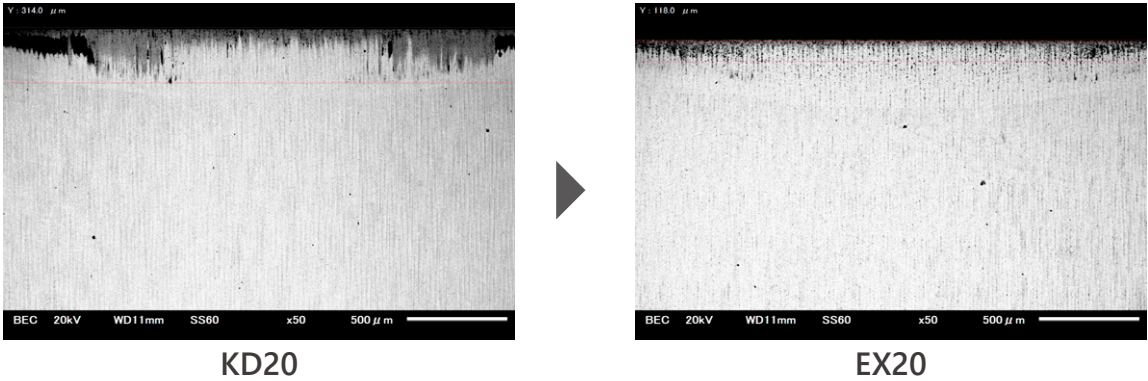
(Typical figures)

### Comparison of wear

#### ① Comparison of wear by press material's adhesion



#### ② Adhesion of pressed material



Both of die cutting/staking molds have to have longer life to extend a maintenance period of mold for motor core. EVERLOY EX grade and EW grades have a high possibility to make the maintenance period longer.

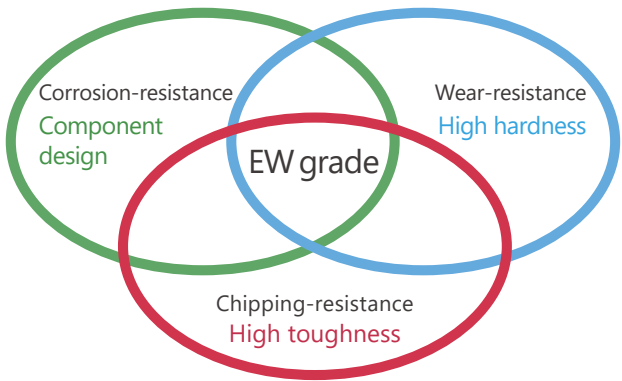
Cemented carbide for magnetic steel sheet die cutting - EW grade

Line up ... EW10, EW25, EW40

High hardness, toughness and corrosion-resistant cemented carbide

Optimized resistance balance of wear, chipping and corrosion.  
Suppresses cracking and chipping which often occur on processing magnetic steel sheet.

Explanation	Resistance of cracking, chipping and defects can be improved without using softer material as fracture toughness is relatively high, compared to the materials with same hardness. Corrosion-resistance is excellent also.
Applications	Magnetic steel sheet. For wear-resistant parts which has concern about chipping or defect, EDM process or WEDM (water type) processing in prolonged manufacturing.



Physical properties of EW grade

Our grade	Co content [%]	Density [ $\times 10^3 \text{kg/m}^3$ ]{g/cm <sup>3</sup> }	Hardness HRA	TRS [GPa]	Fracture toughness value [MPa · m <sup>1/2</sup> ]
EW10	7	14.8	91.0	3.5	15
EW25	11	14.3	89.5	3.5	22
EW40	15	13.9	88.0	3.5	29

(Typical figures)

Characteristics

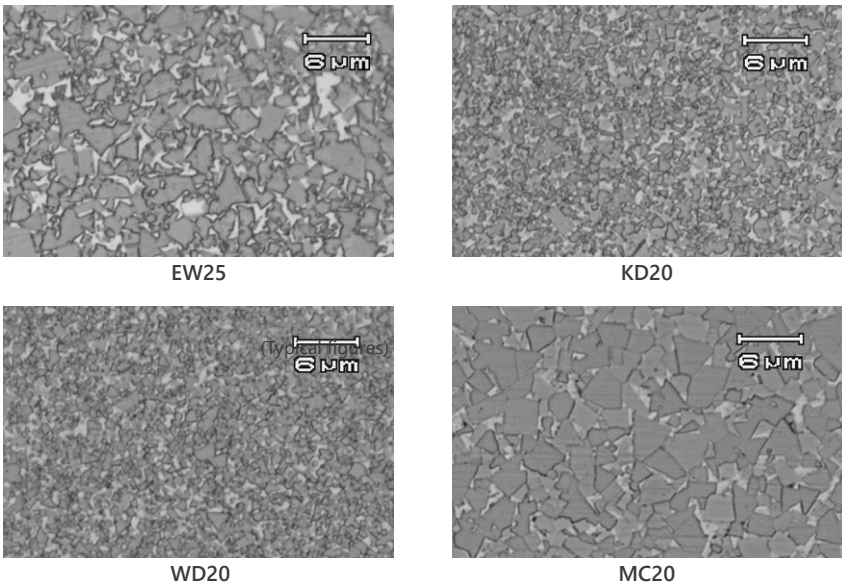
Our grade	WC grain size [μm]	Binder phase content [%]	Density [ $\times 10^3 \text{kg/m}^3$ ]{g/cm <sup>3</sup> }	Hardness HRA	TRS [GPa]	Fracture toughness value [MPa · m <sup>1/2</sup> ]
EW25	1.0 - 2.5	11	14.3	89.5	3.5	22
KD20	1.0 (less than)	13	14.2	90.0	3.7	16
WD20	1.0 (less than)	13	14.1	90.5	3.7	16
MC20	2.5 - 5.0	6	14.9	90.0	2.8	19

(Typical figures)

Cemented carbide for magnetic steel sheet die cutting - EW grade

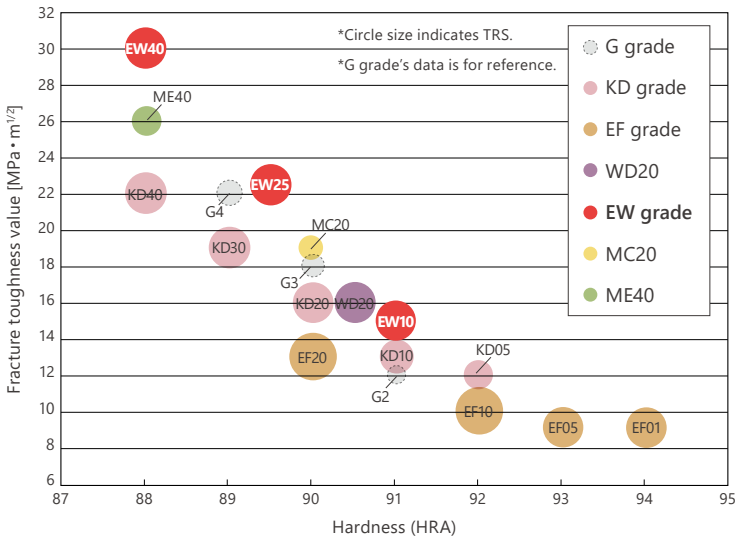
Line up ... EW10, EW25, EW40

Micrographs



By metallurgical microscope (×1000)

Positioning in corrosion-resistant cemented carbide



Performance of corrosion-resistance

After 100 hours immersion during WEDM (water type) process.

