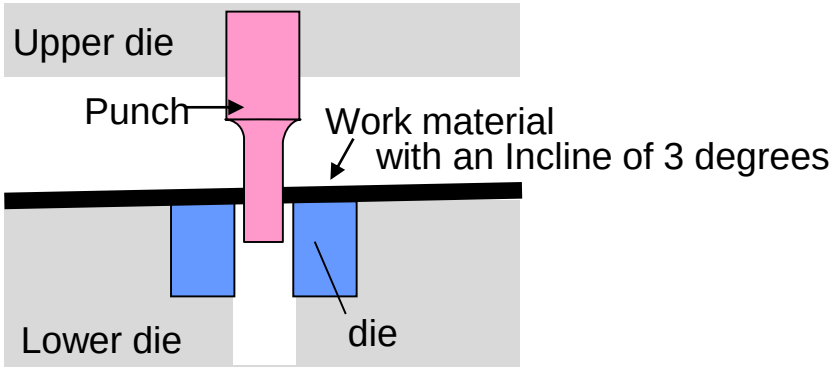
The application of DCMX™

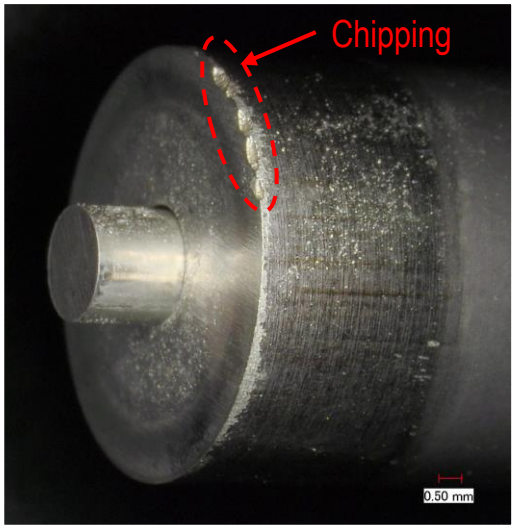
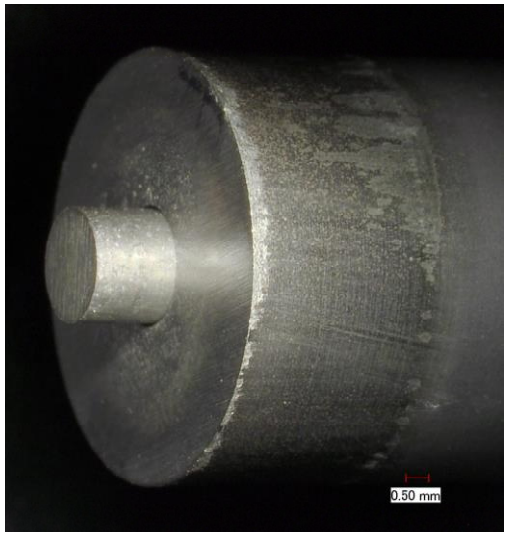
Technical Data No. SD1901

Daido Steel Co., Ltd.
Tool Steel Solution Dept.
Tool Steel Div.

1. Piercing Punch: Trial result

- Tool: φ10.2mm PVD coated punch for progressive die
- Work material: High strength steel sheet, 780MPa, t=1.6mm
- Clearance: 1.45 mm (about 10% of the sheet thickness)
- Cycle time: 55spm
- Failure mode: Chipping at the edge



	
JIS SKD11 (DIN 1.2379/ AISI D2 eq.) (59HRC)	**DCMX (62HRC)**
Die life = 10,000 shot	Die life = **more than 10,000 shot**

Source: Nakahama, Conference on Die and Mould Technology, Presentation file, June 2010.

1. Piercing Punch: Analysis result

Reducing coarse carbides to reduce chipping

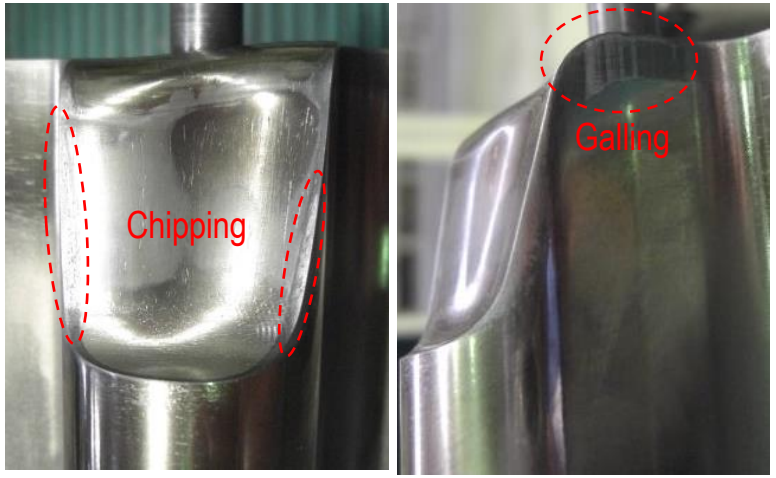
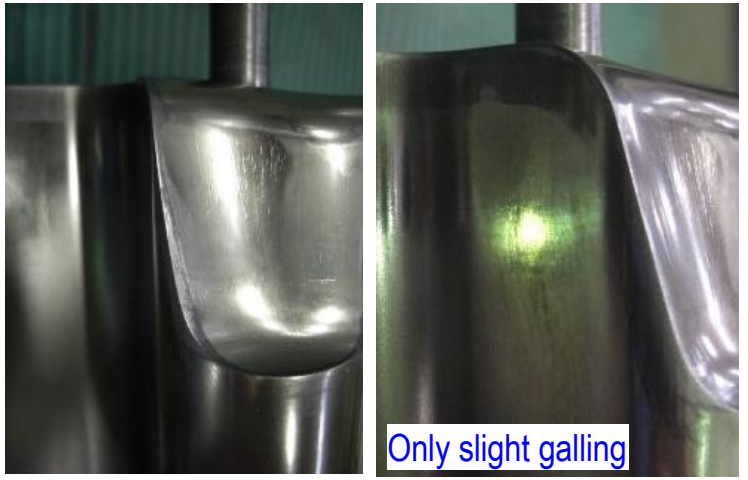
JIS SKD11 (DIN 1.2379/ AISI D2 eq.) has a lot of primary coarse carbides. The coarse carbides might be a chipping initiation site. DCMX has almost no primary coarse carbides, it is a matrix type cold work steel. So, DCMX has contributed to reduce the chipping risk.

Improving the fatigue property and toughness

The crack occurred because the punch was being run thousands of shots. From this reason, the punch needs the high fatigue property and high toughness to prevent the crack. Basically, DCMX (62HRC) has higher fatigue property and toughness than JIS SKD11 (59HRC). So, DCMX has contributed to prevent the chipping.

2. Trimming Punch : Trial result

- Product: Cross member
- Tool size: H80 x W110 x L130mm
- Heat treatment: High temperature tempering
- Surface treatment: PVD coating
- Work material: High strength steel sheet,440MPa, t=2.9mm
- Failure mode: Galling and Chipping

	
JIS SKD11 modified steel grade (59.5 HRC)	**DCMX (61.5 HRC)**
Die life = 80,000 ~ 120,000 shot	Die life = **200,000 shot** Only slight galling, no chipping

Source: Nakahama, Technical papers of Conference on Die and Mould Technology, June 2010, p.228-229
Nakahama, Kata-Gijyutsu (Die and Mould Technology), 2010, Vol.25, No.7, p.134-135

2. Trimming Punch: Analysis result

Improving the fatigue property and toughness

The crack occurred because the punch was being run thousands of shots. From this reason, the punch needs the high fatigue property and high toughness to prevent the crack. In case of this trial, DCMX (62HRC) has higher fatigue property and toughness than competitive steel grade (60HRC). So, DCMX has contributed to prevent the chipping.

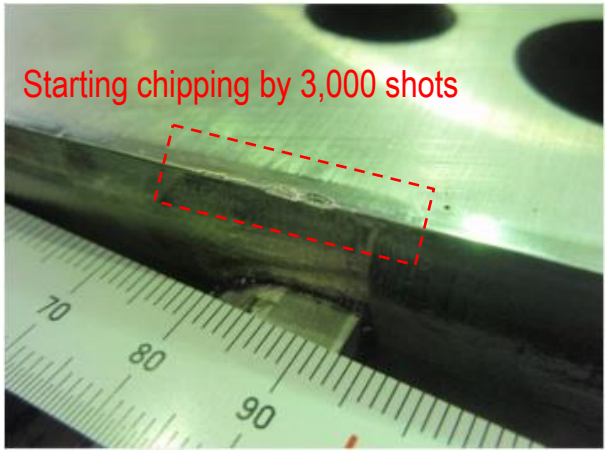
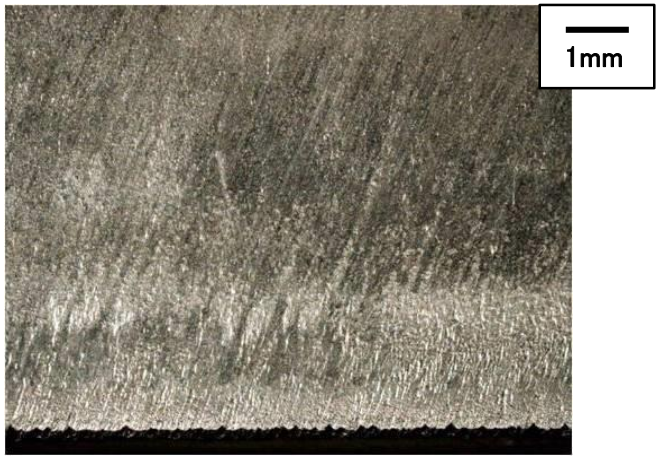
Increasing hardness (DCMX can get over 60HRC with 1030℃ hardening)

The galling was the streaky scratch from the chipping point, it was high possibility that wear due to the jamming by burr of work material and die material.
So, keeping the PVD coating was important for this die to prevent the galling.
Generally, higher hardness makes to improve the adhesive strength of ceramic coating.
The higher hardness of DCMX (62HRC) compared to competitive steel grade has contributed to prevent the galling.

Source: Nakahama, Technical papers of Conference on Die and Mould Technology, June 2010, p.228-229
Nakahama, Kata-Gijyutsu (Die and Mould Technology), 2010, Vol.25, No.7, p.134-135

3. Shearing Blade : Trial result

- Tool size: H80 x W110 x L130mm
- Heat treatment: High temperature tempering
- Surface treatment: No coating
- Work material: High strength steel sheet,440MPa, t= 4 ~ 6mm
- Failure mode: Chipping

	
JIS SKD11 (DIN 1.2379/ AISI D2 eq.) (59HRC)	**DCMX (59HRC)**
Die life = 20,000 shot	Die life = **88,000 shot**

Source: Suzuki, Technical papers of Conference on Die and Mould Technology, June 2012, p.96-97
Suzuki, Kata-Gijyutsu (Die and Mould Technology), 2012, Vol.27, No.7, p.004-005

3. Shearing Blade: Analysis result

Reducing coarse carbides to reduce chipping

JIS SKD11 (DIN 1.2379/ AISI D2 eq.) has a lot of primary coarse carbides. The coarse carbides might be a chipping initiation site. DCMX has almost no primary coarse carbides, it is a matrix type cold work steel. So, DCMX has contributed to reduce the chipping risk.

Improving the fatigue property and toughness

The crack occurred because the punch was being run thousands of shots. From this reason, the punch needs the high fatigue property and high toughness to prevent the crack. Basically, DCMX (59HRC) has higher fatigue property and toughness than JIS SKD11 (59HRC). So, DCMX has contributed to prevent the chipping.

Source: Suzuki, Technical papers of Conference on Die and Mould Technology, June 2012, p.96-97
Suzuki, Kata-Gijyutsu (Die and Mould Technology), 2012, Vol.27, No.7, p.004-005

Other applications

Tool	Products Work: TS, Thickness Coating	Die life	
		Conventional steels	DCMX
Cutting blade*	Lower arm 590MPa, t=2.6mm PVD coating	SKD11 mod. (58 HRC) 50,000 shot Chipping	(61 HRC) More than 50,000 shot No chipping
Blanking die*	Blank 590MPa, t=2.0mm No coating	SKD11 (59 HRC) 2,000~4,000 shot Chipping	(61 HRC) 19,000 shot No chipping
Trimming die*	Center pillar 780MPa, t=1.2mm	SKD11 (61 HRC) 960 shot Chipping	(61 HRC) 33,000 shot No chipping
Trimming die*	590 MPa, t=2,0mm PVD coating	SKD11 mod. (59 HRC) 8,000 shot Galling	(61 HRC) More than 55,000 shot No chipping
Trimming die**	Metal bush Fe-Cu sheet, t=3.7mm	SKD11 (58HRC) 10,000 shot Chipping	(59 HRC) More than 100,000 shot No chipping

*:Source: Nakahama, Technical papers of Conference on Die and Mould Technology, June 2010, p.228-229
Nakahama, Kata-Gijyutsu (Die and Mould Technology), 2010, Vol.25, No.7, p.134-135
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