Metkon Application Note

SAMPLE: Preparation of Hardened Gear sample

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INTRODUCTION

In this application, hardened gear sample used which is shown in the picture below.

The purpose of the investigation is to describe hardening layer and microstructure.

Sample dimensions and requested cutting directions. (Hardness 45~50 HRC)

APPLICATION REQUIREMENTS

A. SECTIONING

	Order Code	Description
Equipment Used	*14 56*	*Servocut 301 - MA*
Clamping Device	*15 01* *GR 0170*	*MBU 1031 Quick clamping Device with clamping shoe* *Vise assembly, Left*
Cutting Fluid	*19-902*	*Metcool, Nature Friendly Soluble Oil,5lt.*
Cutting Disc	*19-042*	*TRENO-M Ø 300 mm, for Medium Hard Steels > 23-55 HRC <*

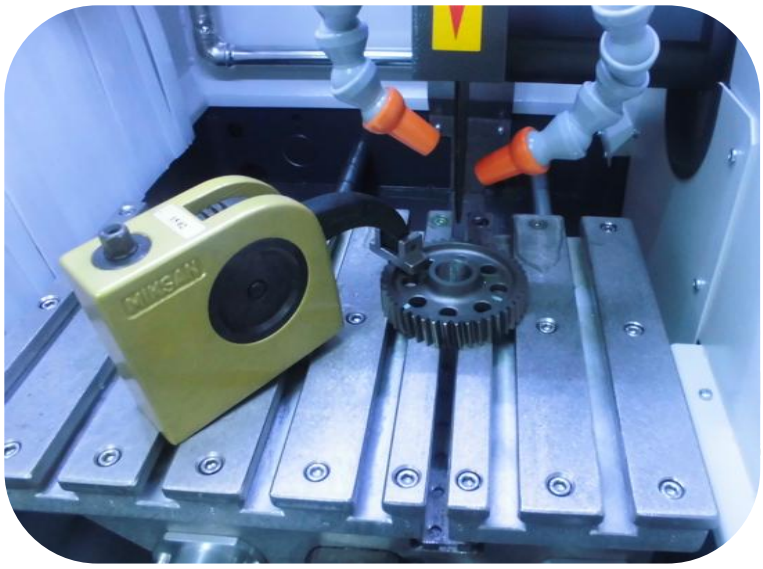
B. MOUNTING

	Order Code	Description
Equipment Used	*25 07*	*Ecopress 100*
Mould Assembly	*26 06 - 02*	*Mould assembly 40 mm diameter*
Mounting Powder	*29-012* *29-011*	*Diallyphtalat, 1 kg.* *Epoxy, Hard 1 kg.*

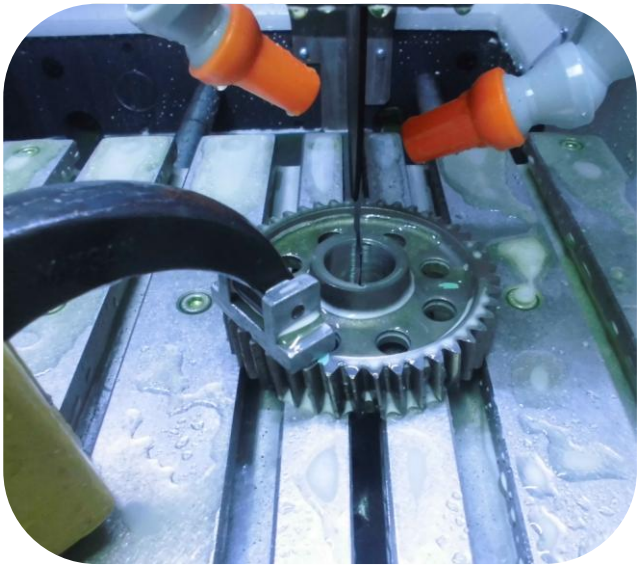
C. GRINDING & POLISHING

	Order Code	Description
Equipment Used	*45 03*	*DIGIPREP 251 Grinding & Polishing System*
Equipment Accessories	*31 22* *31 63* *39-003-250* *39-093-250*	*Aluminum wheel, 250 mm* *Splash Guard, 250 mm* *Ø 250 mm, Special Magnetic Foil* *Ø 250 mm, Thin Metal Plate(5 pcs.)*
Sample Holder	*33 01*	*Specimen holder, 6 x Ø40 mm*

SAMPLE PREPARATION PROCESSES



The sample is attached as it shown in the above photo with the **15 01** clamping device.

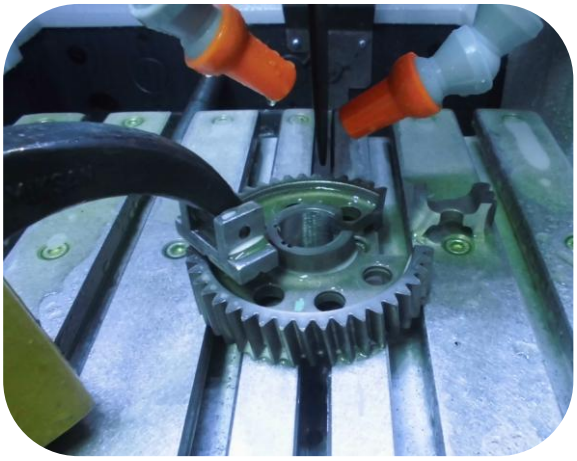
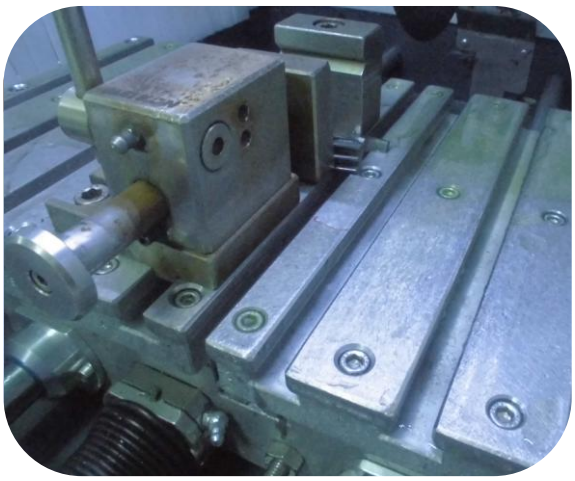



After first cutting the sample moved a little to get a slice and get gear teeth

The cutting parameters are below;

Table feed rate is adjusted to; **200 µ / sec**
Rpm is adjusted to; **2200**
Travel is adjusted to; **55 mm**
Force is adjusted to; **7A**

With these parameters, 2 cutting process took approx. 6-7 minutes.

The final piece divided into two parts for molding operation


ECOPRESS 100 was used for mounting operation with below parameters;

Heating temperature: 180 ^{o}C
Pressure: 240 bar
Heating time: 3 min
Cooling type: Standard cooling
Cooling temperature: 35 ^{o}C

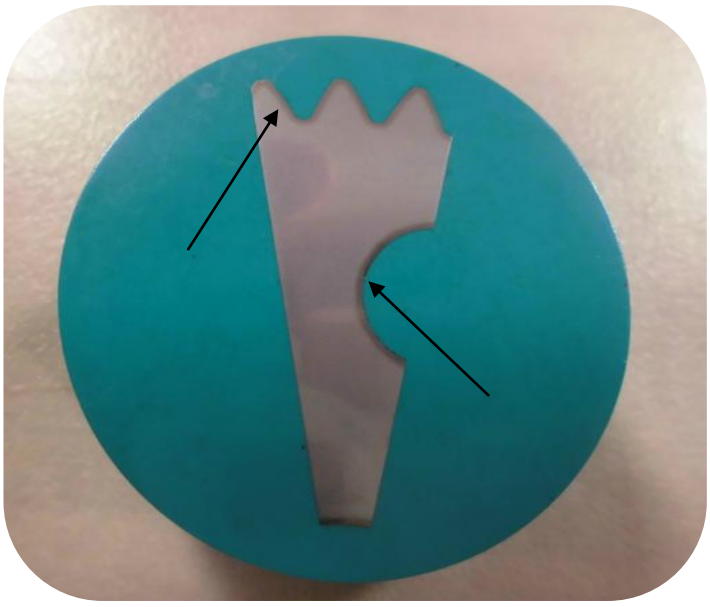
The Mounting process took approx. 10 minutes,

We used Digiprep 251 machine to grind and polish the samples with following parameters.

The grinding &polishing process took app. 10 min.

	Surface	***Abrasive***	***Lubricant***	***Force per sample(N)***	***Time(min.)***	***Disk speed(rpm)***	***Head speed(rpm)***
Grind. Step 1	*MAGNETO I* [38-040-054]	54 micron Diamond	Water	20 N	1 min.	200	*100*
Grind. Step 2	*MAGNETO II* [38-040-018]	18 micron Diamond	Water	25 N	2 min.	250	*100*
Polishing Step 1	SATO cloth [39-013-250]	*6µ diamond susp.* [39-430-M]	*DIAPAT* [39-502]	25N	3 min.	200	*100*
Polishing Step 2	FEDO-1 cloth [39-065-250]	*1µ diamond susp.* [39-410-M]	*DIAPAT* [39-502]	20N	3 min.	200	*100*
Etching	3% Nital solution						

After grinding & polishing operation



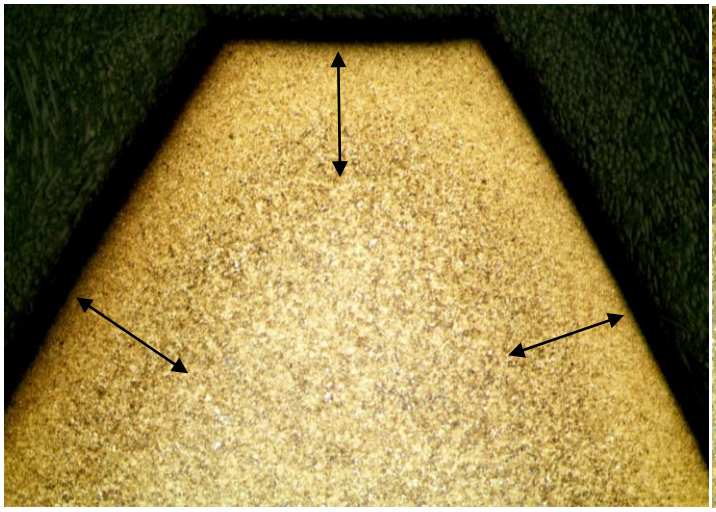
After etching procedure (hardened layer can be seen)

RESULT

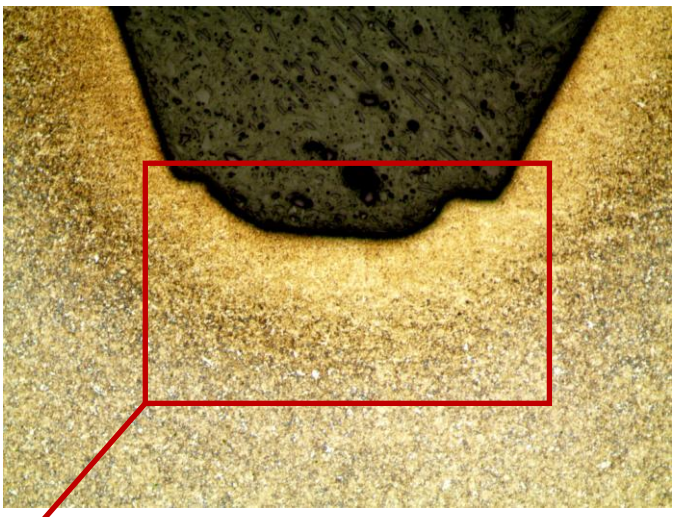
As a result hardened sample was subjected to the following operations;

Cutting → Mounting → Grinding → Polishing → Etching → Microscopic determination

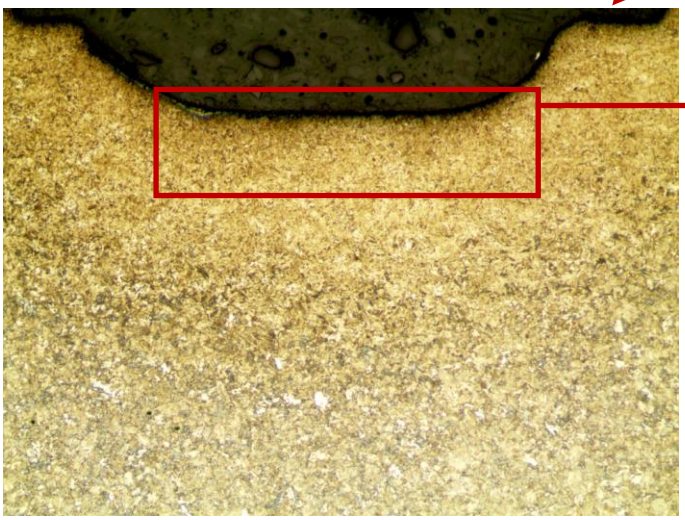
Microstructure images of specimens following for hardening zone and base material.



Hardening zone **x50**



x50



x100

x200

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