metkon
Technology behind Specimen

METKON

Application Note

Metallographic preparation of sensor (for exhausting gas)

INDEX

20 YEARS

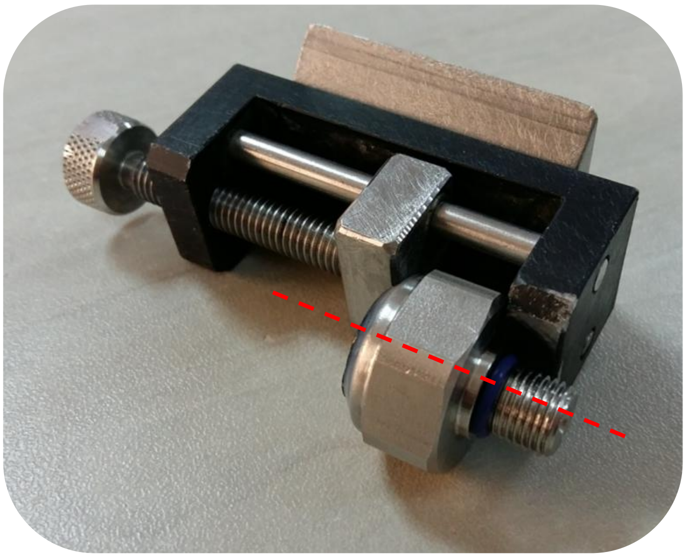
Introduction

Automotive oxygen sensors, colloquially known as O_2 sensors, make modern electronic fuel injection and emission control possible. They help determine, in real time, if the air–fuel ratio of a combustion engine is rich or lean. Since oxygen sensors are located in the exhaust stream, they do not directly measure the air or the fuel entering the engine but when information from oxygen sensors is coupled with information from other sources, it can be used to indirectly determine the air-fuel ratio. Closed loop feedback-controlled fuel injection varies the fuel injector output according to real-time sensor data rather than operating with a predetermined (open-loop) fuel map. In addition to enabling electronic fuel injection to work efficiently, this emissions control technique can reduce the amounts of both unburnt fuel and oxides of nitrogen entering the atmosphere. Unburnt fuel is pollution in the form of air-borne hydrocarbons, while oxides of nitrogen (NO_x gases) are a result of combustion chamber temperatures exceeding 1,300 Kelvin due to excess air in the fuel mixture and contribute to smog and acid rain.

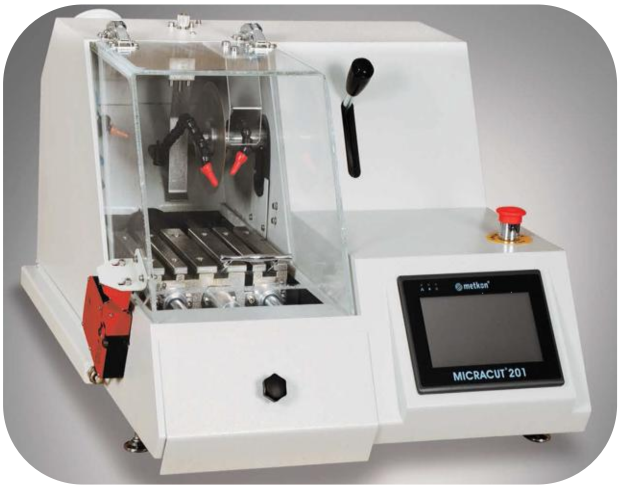
The sensor does not actually measure oxygen concentration, but rather the difference between the amount of oxygen in the exhaust gas and the amount of oxygen in air. Rich mixture causes an oxygen demand. This demand causes a voltage to build up, due to transportation of oxygen ions through the sensor layer. Lean mixture causes low voltage, since there is an oxygen excess.

In this application, sensor (for exhausting gas from automobile) sample will cut with longitudinal direction.

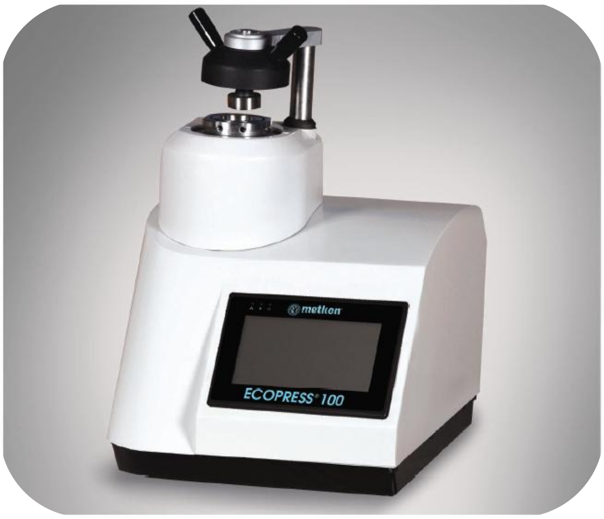
Sample and cutting direction:



Application Requirements



	Order Code	Description
Equipment Used	17 06	MICRACUT 201
Clamping Device	GR 0825	Manual X-axis positioning unit
	GR 0453	Fastener vise for longitudinal sectioning
Cooling Fluid	19 905	METCOOL II Cooling Fluid, 1 lt.
Cutting Disc	19-150	DIMOS Ø150 mm

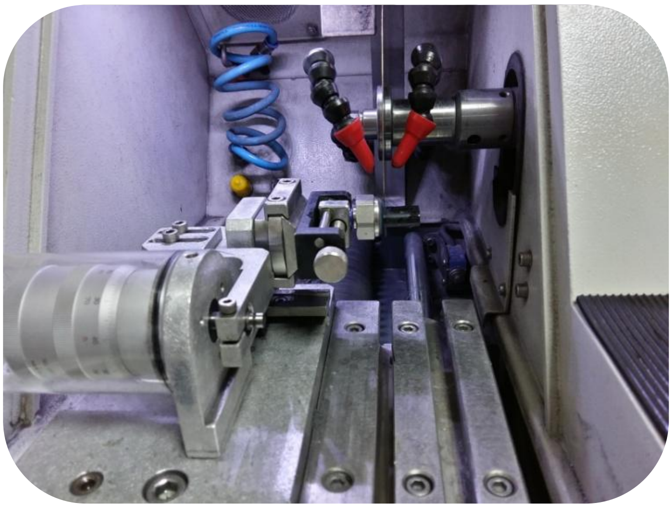


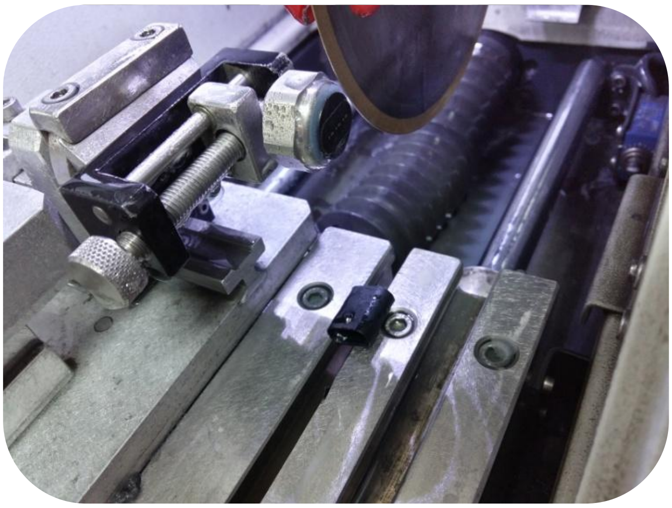
	Order Code	Description
Equipment Used	25 07	ECOPRESS 100
	26 06-02	Mould Assembly, 40mm
Mounting Powder	29-010	NET 1kg.

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

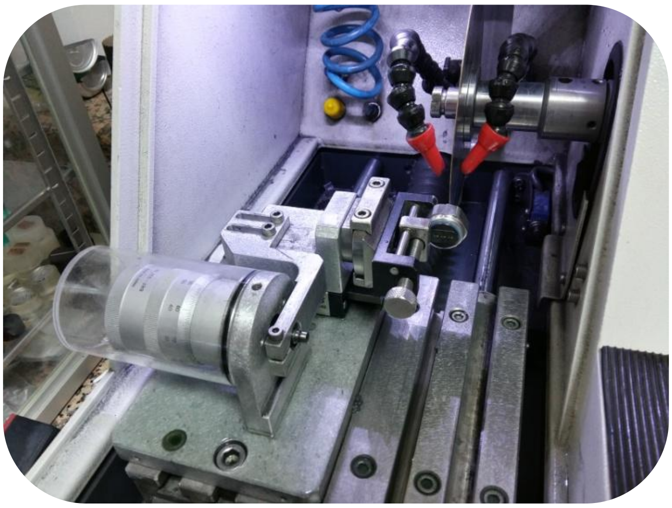
Samples clamped with the GR 0453 Fastener vise and fix to the MICRACUT 201 table with the help of GR 0825 Manual X-axis positioning unit.

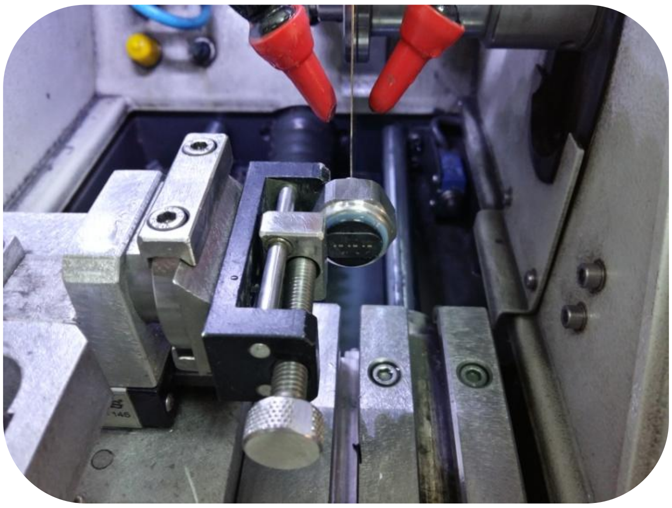
First, plastic connector was cut.

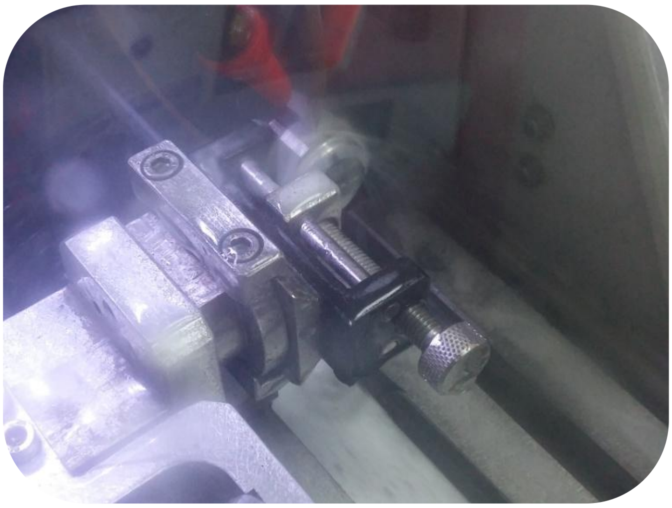


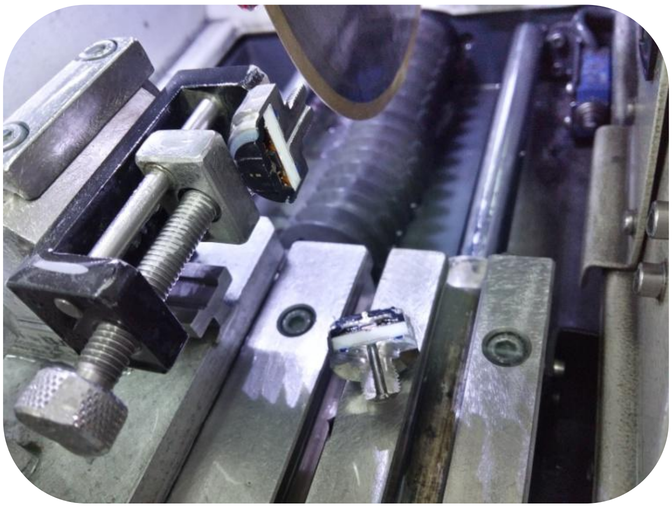


In the second cutting, sample was cut with longitudinal direction.



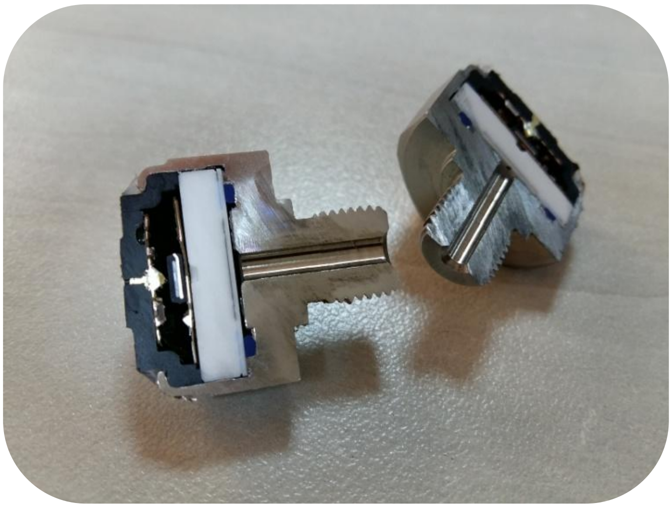






Cutting parameters are:
Feed rate: 50 μ/sec. **RPM**: 3000 r/min.

Sample mounted with ECOPRESS 100 Automatic mounting press.



Mounting parameters;

Heating Temperature : 180ºC
Pressure : 250 bar
Heating Time : 3 mins.
Cooling Type : Slow cooling Open:5 Close:30
Cooling Temperature : 35ºC

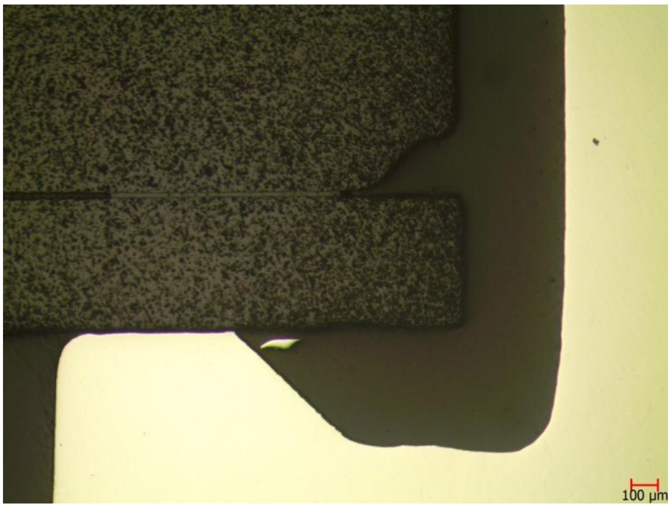
Samples have been prepared with the parameters below;

	Surface	*Abrasive*	*Lubricant*	*Force per sample(N)*	*Time(min.)*	*Disk speed(rpm)*	*Head speed(rpm)*
Grind. Step 1	*DEMPAX* [38-040-320]	320 grit SiC	Water	20 N	Until Plane.	250 CW	*100 CW*
Grind. Step 2	*DEMPAX* [38-040-600]	600 grit SiC	Water	20 N	2 min.	250 CW	*100 CW*
Grind. Step 3	*DEMPAX* [38-040-1200]	1200 grit SiC	Water	20 N	2 min.	250 CW	*100 CW*
Polishing Step 1	*Metapo-P* [39-013-250]	*DIAPAT-M 6µ* [39-430-M]	*DIAPAT* [39-502]	25 N	4 min.	150 CW	*75 CCW*
Polishing Step 2	*Metapo-B* [39-033-250]	*DIAPAT-M 3µ* [39-420-M]	*DIAPAT* [39-502]	25 N	2 min.	150 CW	*75 CCW*
Polishing Step 3	*FEDO-1* [39-065-250]	*DIAPAT-M 1µ* [39-410-M]	*DIAPAT* [39-502]	20 N	1 min.	150 CW	*50 CCW*

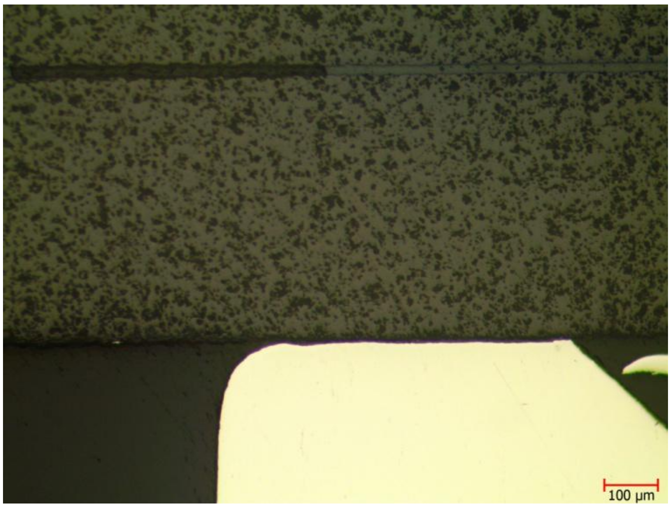
Result

Sample photos from under the microscope.

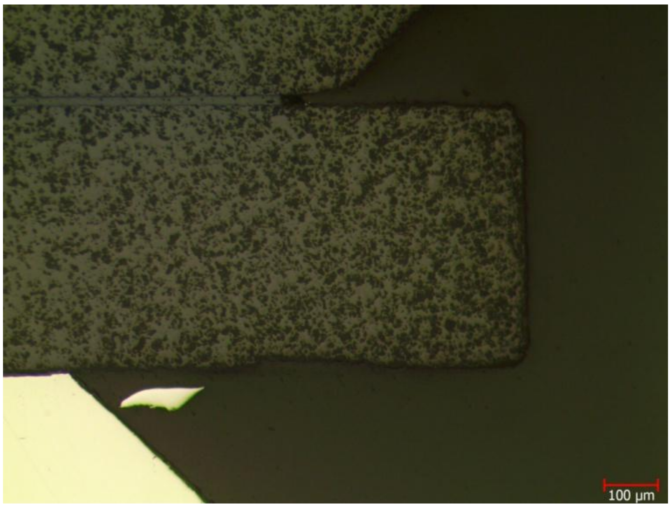
50x



50x



100x



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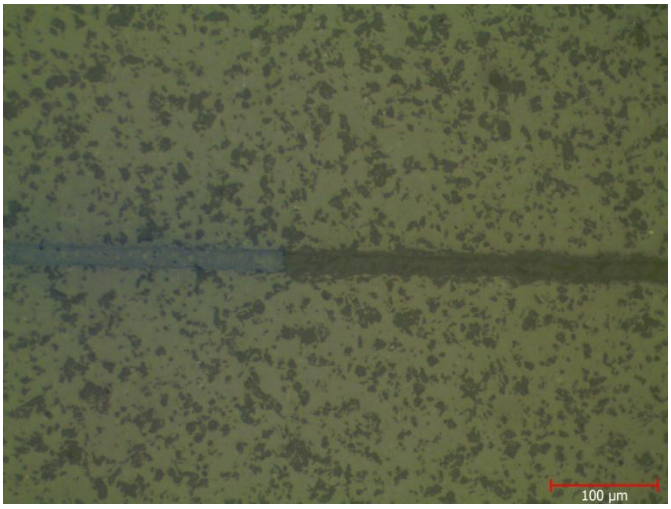

200x

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