metkon
Technology behind Specimen

MOST COMMON METALLOGRAPHIC APPLICATIONS IN

AUTOMOTIVE INDUSTRY


x 1000
x 1000
76%
57%
23%
42%
140
90
50
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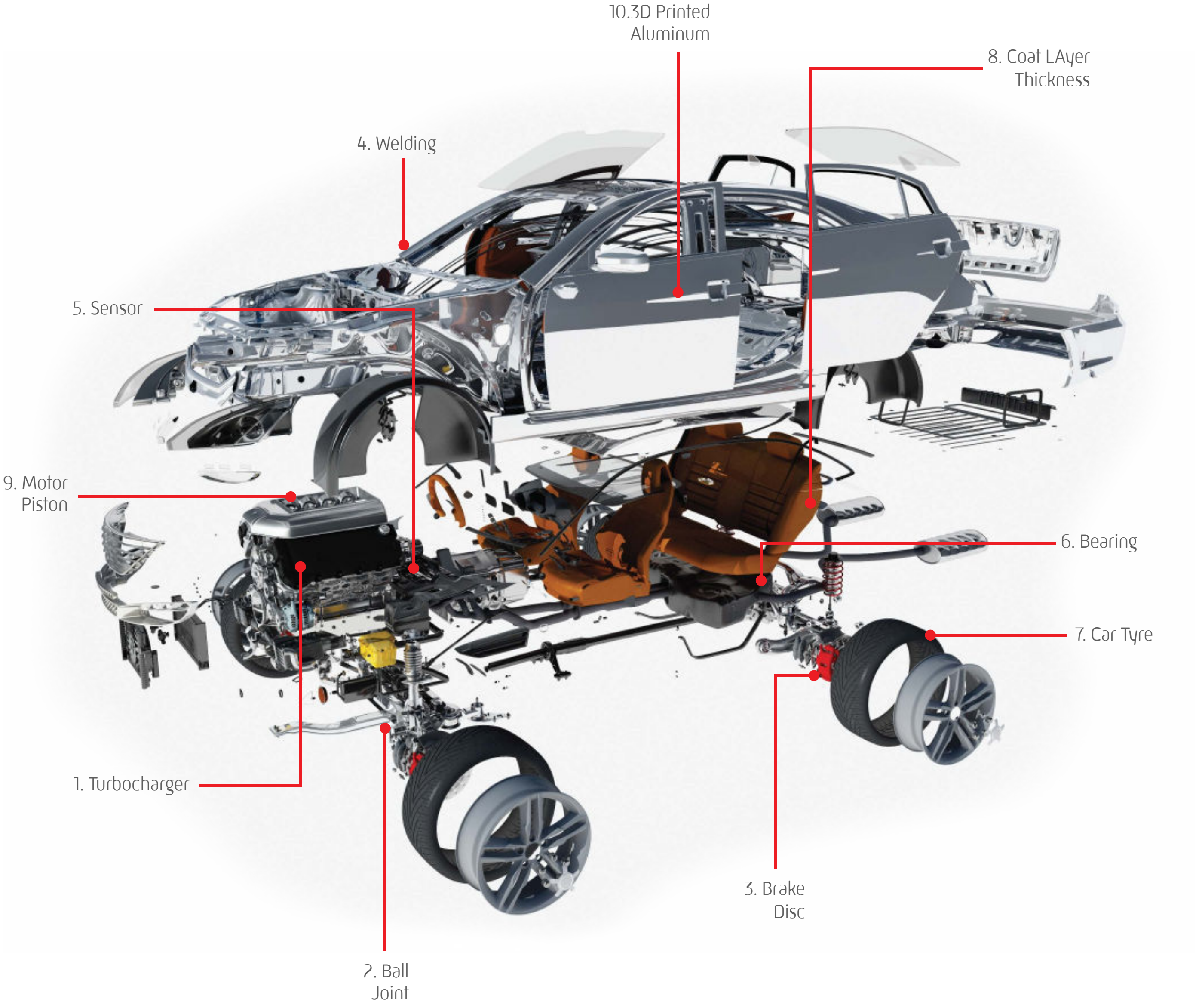
E

OUR NEWEST SOLUTIONS FOR THE AUTOMOTIVE INDUSTRY

The automotive industry has changed enormously in almost every detail of materials and manufacturing, over recent years aimed at improving performance, weight and strength. With respect to material changes, vehicle bodies were based on conventional cold-rolled steel and have evolved into new high-strength, galvanized, dent, crash and corrosion resistant steels, aluminum, magnesium, polymeric, and metal matrix composites make up a growing list of lightweight materials.

Through our Application Notes, we offer metallographic sample preparation solutions to optimize your processes. All Application Notes are prepared by our experienced metallographers to solve your everyday problems.

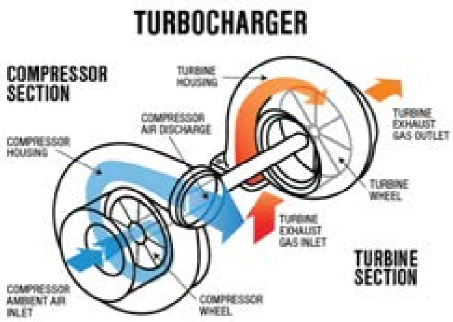


1. METALLOGRAPHIC CUTTING OPERATION OF TURBOCHARGER

INTRODUCTION

A turbocharger, or colloquially turbo, is a turbine-driven forced induction device that increases an internal combustion engine's efficiency and power output by forcing extra air into the combustion chamber. This improvement over a naturally aspirated engine's power output is due to the fact that the compressor can force more air—and proportionately more fuel—into the combustion chamber than atmospheric pressure (and for that matter, ram air intakes) alone.

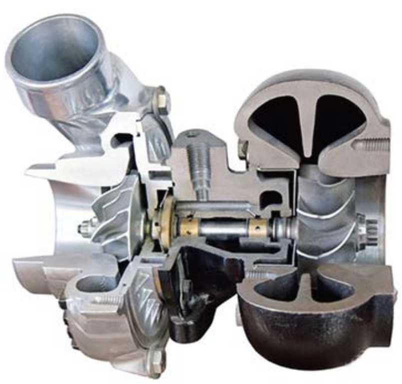
Turbochargers were originally known as turbosuperchargers when all forced induction devices were classified as superchargers. Nowadays the term "supercharger" is usually applied only to mechanically driven forced induction devices. The key difference between a turbocharger and a conventional supercharger is that a supercharger is mechanically driven by the engine, often through a belt connected to the crankshaft, whereas a turbine driven by the engine's exhaust gas powers a turbocharger. Compared with a mechanically driven supercharger, turbochargers tend to be more efficient, but less responsive. Twin charger refers to an engine with both a supercharger and a turbocharger.



Turbochargers are commonly used on truck, car, train, aircraft, and construction equipment engines. They are most often used with Otto cycle and Diesel cycle internal combustion engines. They have also been found useful in automotive fuel cells

In this application, Turbo charger part will be cut from requested cutting line.

Type of material: SUS+Inconel



SAMPLE PREPARATION PROCESES

Specimen was fixed with Vertical Clamping Devices to the SERVOCUT 602 table. Also cutting was operated with Z axis movement

Cutting parameters:
Feedrate : 100 µ/sn.
RPM : 1800 r/min .

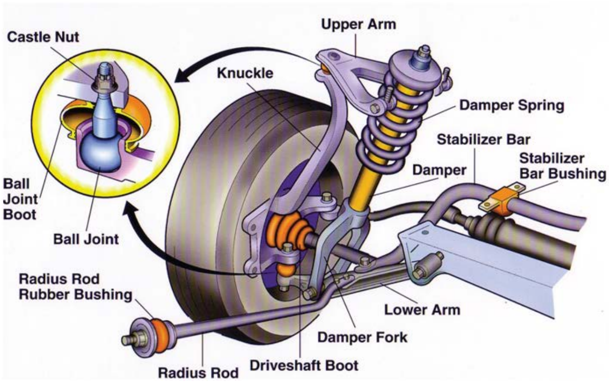
RESULT

Finally, sample cut properly.

2. METALLOGRAPHIC CUTTING PREPATION OF BALL JOINT

INTRODUCTION

In automobiles, a double wishbone (or upper and lower A-arm) suspension is an independent suspension design using two (occasionally parallel) wishbone-shaped arms to locate the wheel. Each wishbone or arm has two mounting points to the chassis and one joint at the knuckle. The shock absorber and coil spring mount to the wishbones to control vertical movement. Double wishbone designs allow the engineer to carefully control the motion of the wheel throughout suspension travel, controlling such parameters as camber angle, caster angle, toe pattern, roll center height, scrub radius, scuff and more.



Samples that will cut and their cutting line:

SAMPLE PREPARATION PROCESES

GR 0032 and 15 02 clamping devices has choose for this cutting operation.

With the help of laser unit, sample has positioned quickly from the requested cutting line.

Cutting parameters

Feed rate : 100µ /sec.

RPM : 2200 r /min.

RESULT

As a result, sample has cut properly from the requested observation points. Ready for further operations.

3. METALLOGRAPHIC PREPARATION OF DISC BRAKE

INTRODUCTION

The brake disc (or rotor) is the rotating part of a wheel's disc brake assembly, against which the brake pads are applied. The material is typically gray iron a form of cast iron. The design of the discs varies somewhat. Some are simply solid, but others are hollowed out with fins or vanes joining together the disc's two contact surfaces (usually included as part of a casting process). The weight and power of the vehicle determines the need for ventilated discs. The "ventilated" disc design helps to dissipate the generated heat and is commonly used on the more-heavily loaded front discs.

Discs for motorcycles, bicycles, and many cars often have holes or slots cut through the disc. This is done for better heat dissipation, to aid surface-water dispersal, to reduce noise, to reduce mass, or for marketing cosmetics.

In this application, brake disc sample will prepared for Metallographic purpose.

SAMPLE PREPARATION PROCESES

Sample was clamped by the help of 15 06 Vertical Clamping device and fixed to the SERVOCUT 602 table on V blocks.

Cutting Parameters:	
Feed rate	200 μ/sec. (Z axis)
RPM	1400 r/min.
Force	25 A.
Travel	(60 mm.- 80 mm. for slices*), (35 mm. for small parts)
Pulse	0,2 mm.
Time	(About 40 min for 2 slice), (About 6 min. for small parts)

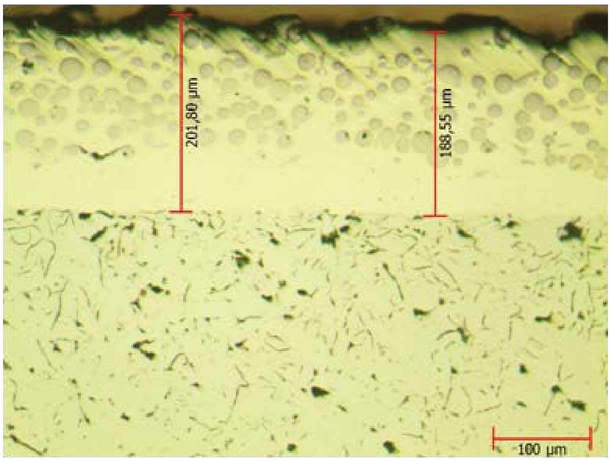
Sample is grinded and polished with FORCIPOL 102 + FORCIMAT 102 using **46 45** "3 rectangular specimens with 40 x 70 mm" Specimen Holder.

	Surface	Abrasive	Lubricant	Force Per Sample (N)	Time Min.	Disc Speed Rpm.	Head Speed Rpm.
Grind. Step 1	MAGNETO 125 38-040-125	Diamond 125 µ	Water	60 N	Depth control*	400 CW	100 CCW
Grind. Step 2	MAGNETO 54 40-020-054	Diamond 54 µ	Water	60 N	3 min.	250 CCW	100 CCW
Final Grinding	MAGNETO 18 39-033-018	Diamond 18 µ	Water	60 N	3 min.	250 CCW	100 CCW
Polishing Step 1	METAPO-P 39-013-250	DIAPAT-M 6µ 39-430-M	DIAPAT [39-502]	60 N	5 min.	150 CW	75 CCW
Final Polishing	METAPO-V 39-043-250	DIAPAT-M 1µ 39-410-M	DIAPAT [39-502]	60 N	3 min.	150 CW	50 CCW

*Depth control has been adjusted to 0,4 mm for clean of hard burrs on the sample edges. This process took about 8 minutes.

RESULT

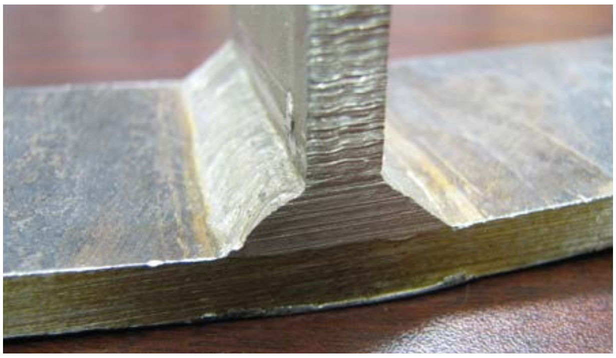
As a result, sample has cut properly from the requested observation point. After grinding and polishing process,coating layer is maesured by IMAGINE system.



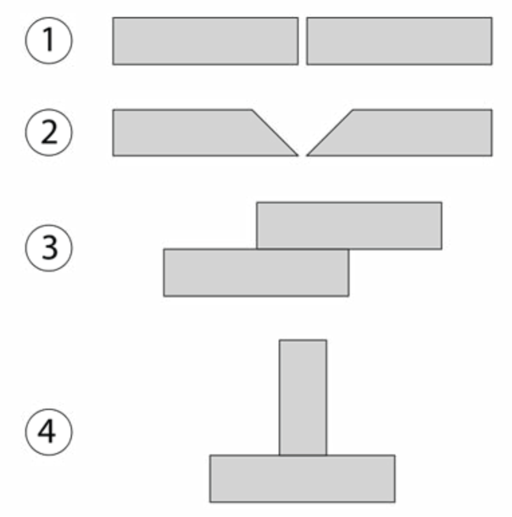
4. WELDING PENETRATION

INTRODUCTION

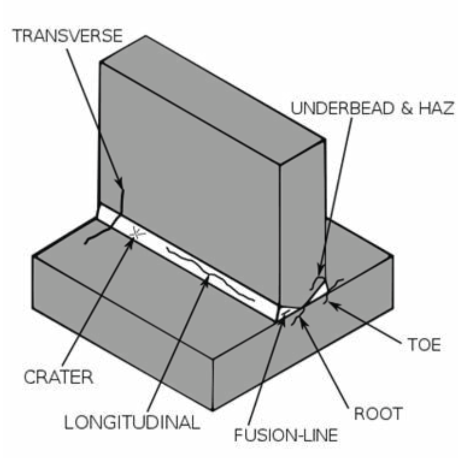
Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work pieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This is in contrast with soldering and brazing, which involve melting a lower-melting-point material between the work pieces to form a bond between them, without melting the work pieces.



Welds can be geometrically prepared in many different ways. The five basic types of weld joints are the butt joint, lap joint, corner joint, edge joint, and T-joint. Other variations exist as well—for example, double-V preparation joints are characterized by the two pieces of material each tapering to a single center point at one-half their height. Single-U and double-U preparation joints are also fairly common—instead of having straight edges like the single-V and double-V preparation joints, they are curved, forming the shape of a U. Lap joints are also commonly more than two pieces thick—depending on the process used and the thickness of the material, many pieces can be welded together in a lap joint geometry.

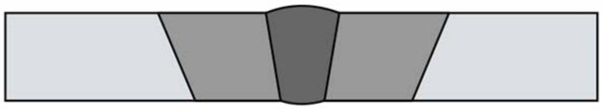


Common welding joint types – (1) Square butt joint, (2) V butt joint, (3) Lap joint, (4) T-joint



After welding, a number of distinct regions can be identified in the weld area. The weld itself is called the fusion zone—more specifically, it is where the filler metal was laid during the welding process.

The properties of the fusion zone depend primarily on the filler metal used, and its compatibility with the base materials. It is surrounded by the heat-affected zone, the area that had its microstructure and properties altered by the weld. These properties depend on the base material's behavior when subjected to heat. The metal in this area is often weaker than both the base material and the fusion zone, and is also where residual stresses are found.



The cross-section of a welded butt joint, with the darkest gray representing the weld or fusion zone, the medium gray the heat-affected zone, and the lightest gray the base material.

Requested welded sample to be investigated

SAMPLE PREPARATION PROCESES

The sample is fied with **46 77** "Universal specimen holder" as shown in the below photo.

The sample is prepared with FORCIPOL 202 + FORCIMAT 102 grinding and polishing machine to grind the samples with following parameters;

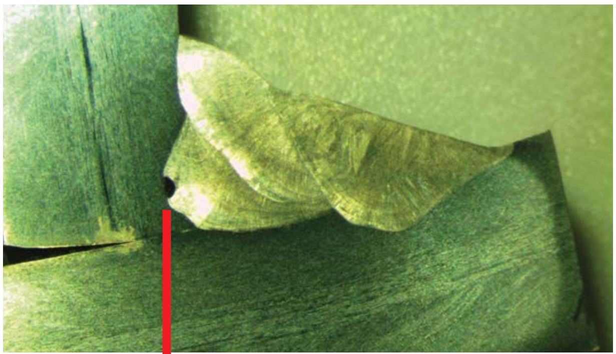
	Surface	Abrasive	Lubricant	Force Per Sample (N)	Time Min.	Disc Speed Rpm.	Head Speed Rpm.
Grind. Step 1	DEMPAX 38-040-320	Diamond 125 µ	Water	25 N	1 min.	300	150
Grind. Step 2	DEMPAX 38-040-800	Diamond 54 µ	Water	25 N	3 min.	300	150
Final Grinding	DEMPAX 38-040-1200	Diamond 18 µ	Water	25 N	3 min.	300	150
Polishing Step 1	FEDO-3 39-025-250	DIAPAT-M 6µ 39-430-M	DIAPAT [39-502]	20 N	5 min.	200	75
Final Polishing	FEDO-1 39-065-250	DIAPAT-M 1µ 39-410-M	DIAPAT [39-502]	20 N	3 min.	200	75

After polishing operation the sample etched with Kalling solution and heat-affected zone can be observed.

RESULT

As a result the chromium steel samples were subjected to the following operations;
Grinding Polishing Etching

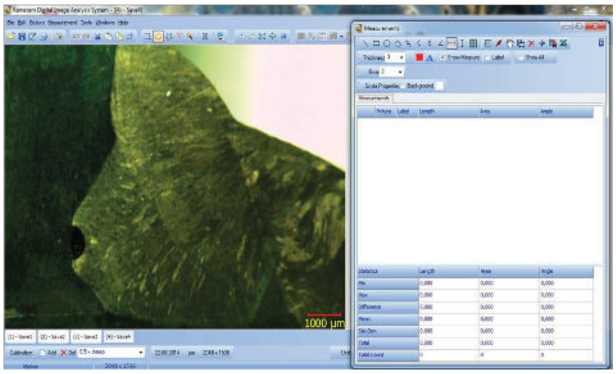
After that the sample examined in PST 901 Stereo Microscope (Order No: 60 02) in order to observe welding penetration value.

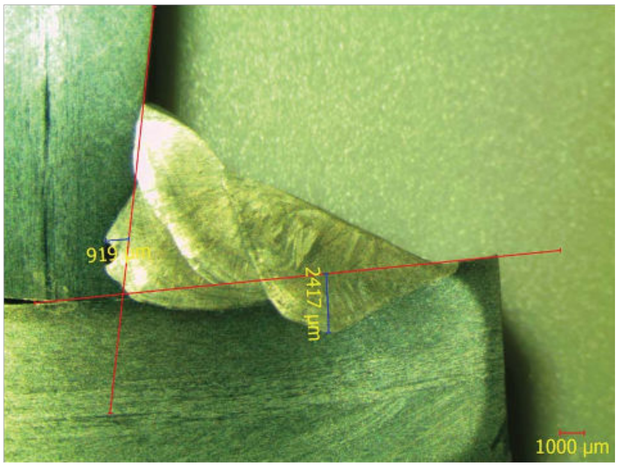


6,5 x

50 x

According to requested inspection several measurements can be done by the help of IMAGINE analysis system.





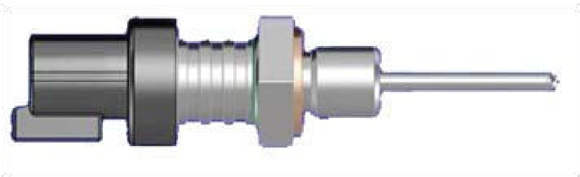
6,5 x

Welding area measured from the penetration zones.

5. METALLOGRAPHIC PREPARATION OF OXYGEN SENSOR

INTRODUCTION

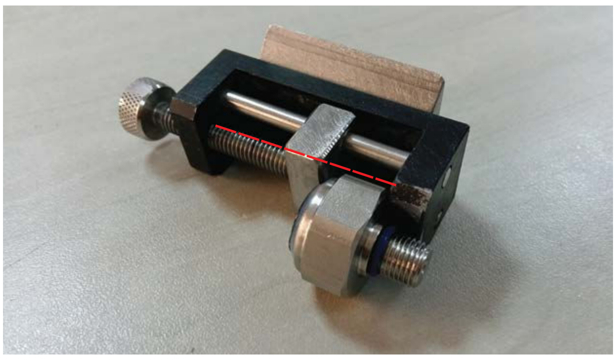
Automotive oxygen sensors, colloquially known as O2 sensors, make modern electronic fuel injection and emission control possible. They help determine, in real time, if the air–fuel ratio of a combustion engine is rich or lean. Since oxygen sensors are located in the exhaust stream, they do not directly 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 (NOx 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:

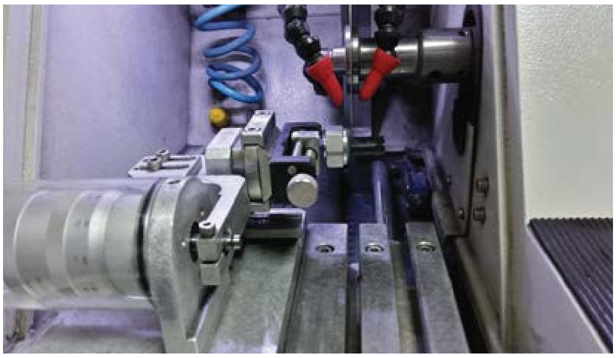


Specimen Holder
GR 0453

SAMPLE PREPARATION PROCESES

Samples clamped with the GR 0453 Fastener vise and fix to the MICRACUT 202 table with the help of GR 0825 Manual X-axis positioning unit.

First, plastic connector was cut.



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

Sample mounted with ECOPRESS 102 Automatic mounting press.

Mounting parameters;

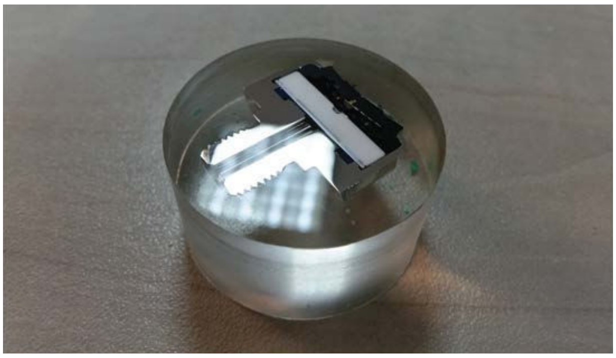
Heating Temperature : 180°C
Pressure : 250 bar
Heating Time : 3 mins.
Cooling Type : Slow cooling Open:5 Close:30
Cooling Temperature : 35°C

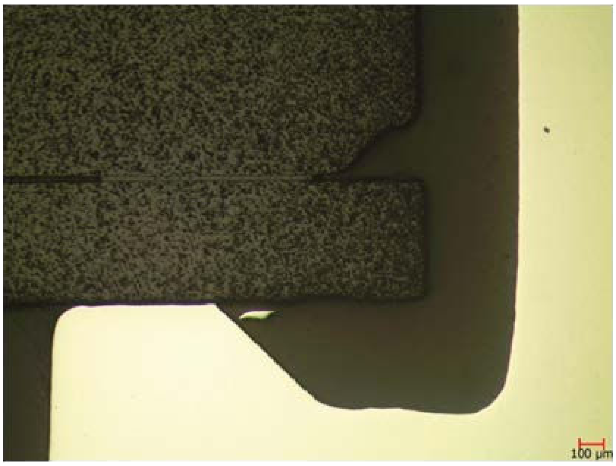
Samples have been prepared with the parameters below;

	Surface	Abrasive	Lubricant	Force Per Sample (N)	Time Min.	Disc 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
Final Grinding	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
Final Polishing	FEDO-1 39-065-250	DIAPAT-M 1µ 39-410-M	DIAPAT [39-502]	20 N	1 min.	150 CW	50 CCW

RESULT

Polished sample and microstructre image is show as below.





50 x

6. METALLOGRAPHIC PREPARATION OF BEARING HOUSING

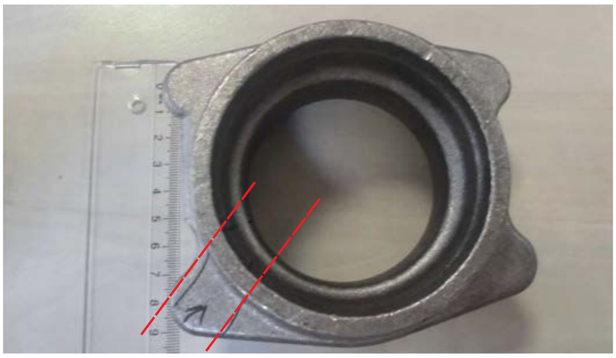
INTRODUCTION

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts.

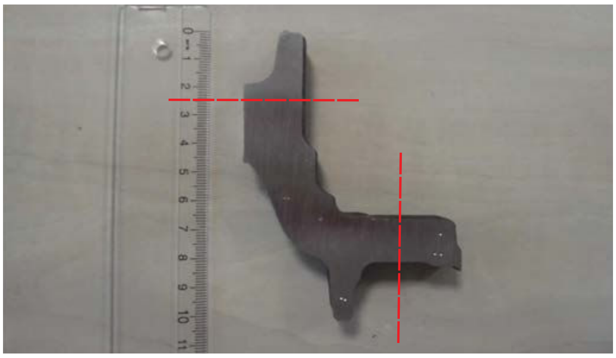
Many bearings also facilitate the desired motion as much as possible, such as by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts. The term "bearing" is derived from the verb "to bear"; a bearing being a machine element that allows one part to bear (i.e., to support) another. The simplest bearings are bearing surfaces, cut or formed into a part, with varying degrees of control over the form, size, roughness and location of the surface. Other bearings are separate devices installed into a machine or machine part. The most sophisticated bearings for the most demanding applications are very precise devices; their manufacture requires some of the highest standards of current technology.

Some bearings that using in automotive industry.

Those samples for metallographic preparation:



Sample 1



Sample 2

SAMPLE PREPARATION PROCESES

With the help of 15 02, sample has clamped and cut with SERVOCUT 302 from requested lines.

Sample 1 and 15 02 vertical clamping device.
After final cutting operation, appearance of sample 2:

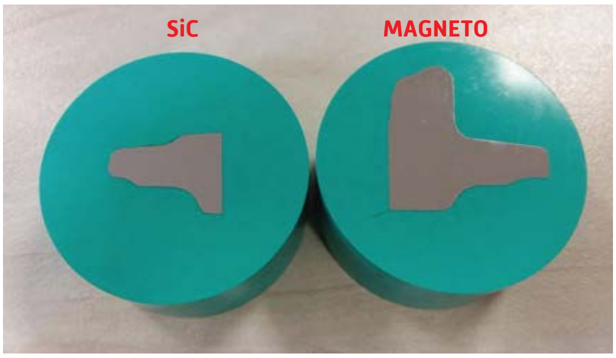
Cutting parameters are same for Sample 1 and Sample 2;

Feedrate	: 150µ/sec.
Force	: 8A.
RPM	: 2000 r/min.

The sample is, Sample 1 mounted with DAP(29-012).

Mounting parameters;

Equipment	: Ecopress 102
Heating Temperature	: 190°C
Pressure	: 260 bar
Heating Time	: 3 mins.
Cooling Mode	: Standart Cooling
Cooling Temperature	: 35°C
Mounting Powder	: DAP (29-012)



Sample 1

The Samples are prepared with FORCIPOL 102 + FORCIMAT 52.
Grinding and polishing parameters are:

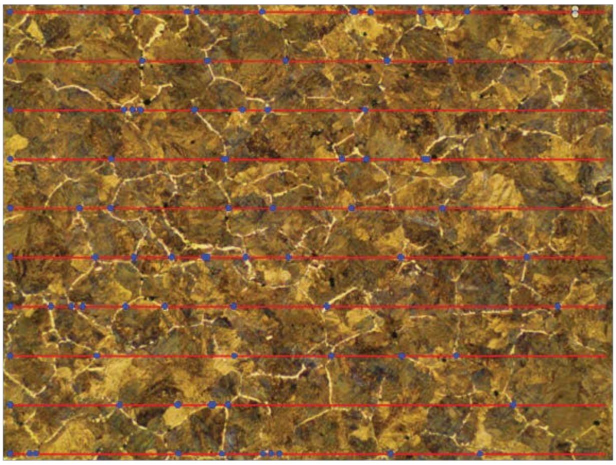
	Surface	Abrasive	Lubricant	Force Per Sample (N)	Time Min.	Disc Speed Rpm.	Head Speed Rpm.
Grind. Step 1	MAGNETO 54 38-040-54	Diamond 54 µ	Water	25 N	1 min.	250 CW	100 CCW
Grind. Step 2	MAGNETO 18 38-040-018	Diamond 18 µ	Water	25 N	1 min.	250 CW	100 CCW
Final Grinding	MAGNETO 6 39-040-006	Diamond 6 µ	Water	25 N	1 min.	250 CW	100 CCW
Polishing Step 1	METAPO-B 39-033-250	DIAPAT-M 3µ 39-420-M	DIAPAT 39-502	20 N	2 min.	150 CW	75 CCW
Final Polishing	FEDO-1 39-065-250	DIAPAT-M 1µ 39-410-M	DIAPAT 39-502	20 N	3 min.	150 CW	75 CCW

*Etching : Nital %10

RESULT

Grain measurement of samples below:

Microstructure photo of the sample prepared with Magneto;



GRAIN SIZE REPORT

Num ASTM (G) Grain Size	Field Area	Intercept Count	Test Line	Average Grain Lenght
				0
Measured Field	1			
Average Grain ASTM(G) Size	1			
Std.Dev.	4			
Measured Total Area	0			
%95 CI	1			
%RA	0			
SIGNED BY	N\A		Unit	mm

7. METALLOGRAPHIC PREPARATION OF CAR TYRE

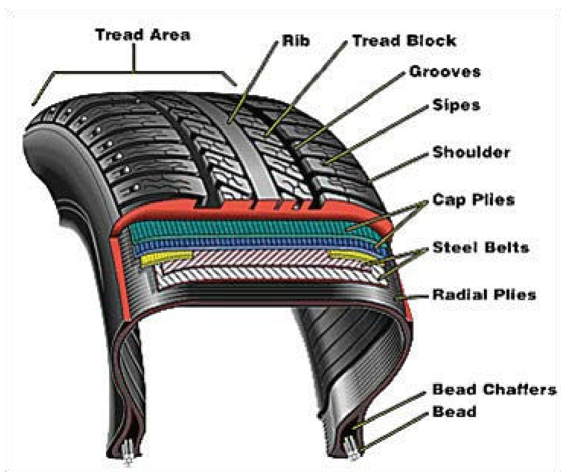
INTRODUCTION

A tire (American English) or tyre (British English; see spelling differences) is a ring-shaped component that surrounds a wheel's rim to transfer a vehicle's load from the axle through the wheel to the ground and to provide traction on the surface traveled over.
Most tires, such as those for automobiles and bicycles, are pneumatically inflated structures, which also provide a flexible cushion that absorbs shock as the tire rolls over rough features on the surface.

The materials of modern pneumatic tires are synthetic rubber, natural rubber, fabric and wire, along with carbon black and other chemical compounds. They consist of a tread and a body. The tread provides traction while the body provides containment for a quantity of compressed air. Before rubber was developed, the first versions of tires were simply bands of metal fitted around wooden wheels to prevent wear and tear. Early rubber tires were solid (not pneumatic). Pneumatic tires are used on many types of vehicles, including cars, bicycles, motorcycles, buses, trucks, heavy equipment, and aircraft. Metal tires are still used on locomotives and railcars, and solid rubber (or other polymer) tires are still used in various non-automotive applications, such as some casters, carts, lawnmowers, and wheelbarrows.

The tread is the part of the tire that comes in contact with the road surface. The portion that is in contact with the road at a given instant in time is the contact patch. The tread is a thick rubber, or rubber/composite compound formulated to provide an appropriate level of traction that does not wear away too quickly.

The design of treads and the interaction of specific tire types with the roadway surface affects roadway noise, a source of noise pollution emanating from moving vehicles. These sound intensities increase with higher vehicle speeds.[58] Tires treads may incorporate a variety of distances between slots (pitch lengths) to minimize noise levels at discrete frequencies. Sipes are slits cut across the tire, usually perpendicular to the grooves, which allow the water from the grooves to escape sideways and mitigate hydroplaning

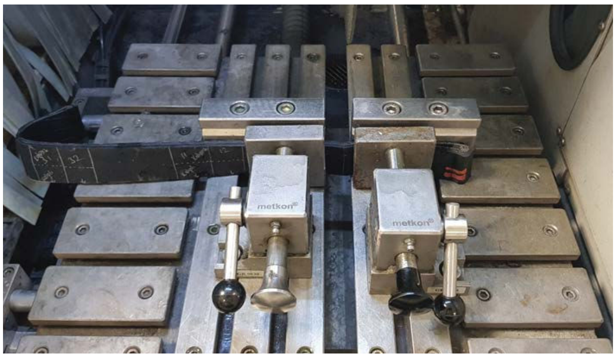


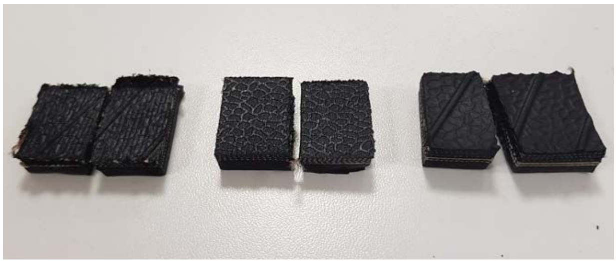
Wear bars (or wear indicators) are raised features located at the bottom of the tread grooves that indicate the tire has reached its wear limit. When the tread lugs are worn to the point that the wear bars connect across the lugs, the tires are fully worn and should be taken out of service, typically at a remaining tread depth of 1.6 millimetres (0.063 in).

In this application, car tire will prepared as Metallographic preparation.

SAMPLE PREPARATION PROCESES

By the help of GR 0029 & GR 0030 Quick Acting Clamping Vise Assemblies, sample fixed on the SERVOCUT 402 table.





3 samples will mounted with DMT 35 cold mounting consumables.

Cold mounting parameters:

Powder: 2 part
Hardener: 1 part

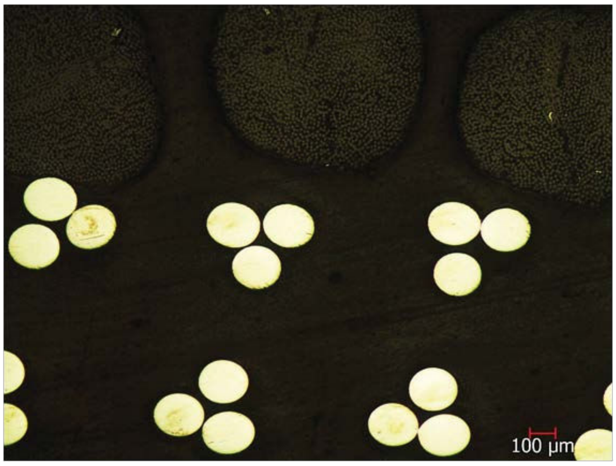
20 grams of powder were mixed with 10 grams of liquid hardener to fill each of the 40 mm diameter form. Curing time of DMT 35 cold molding consumables after mixing is 5-6 minutes.

Cold mounted samples prepared with FORCIPOL 102 + FORCIMAT 52.

	Surface	Abrasive	Lubricant	Force Per Sample (N)	Time Min.	Disc Speed Rpm.	Head Speed Rpm.
Grind. Step 1	DEMPAX 38-040-320	320 grit SiC	Water	10 N	2 min.	250 CW	100 CW
Grind. Step 2	DEMPAX 38-040-600	600 grit SiC	Water	10 N	2 min.	250 CW	100 CW
Final Grinding	DEMPAX 38-040-1200	1200 grit SiC	Water	10 N	2 min.	250 CW	100 CW
Polishing Step 1	DEMPAX 38-040-2500	2500 grit SiC	Water	15 N	4 min.	250 CW	100 CW
Final Polishing	METAPO-B 39-033-250	DIAPAT-M 3µ 39-420-M	DIAPAT [39-502]	20 N	5 min.	200 CW	75 CCW

RESULT

Microstructure photo is seen as below.



8. MEASUREMENT OF COAT LAYER THICKNESS

INTRODUCTION

A coating is a covering that is applied to the surface of an object, usually referred to as the substrate. The purpose of applying the coating may be decorative, functional, or both. The coating itself may be an all-over coating, completely covering the substrate, or it may only cover parts of the substrate.

Paints and lacquers are coatings that mostly have dual uses of protecting the substrate and being decorative, although some artist's paints are only for decoration, and the paint on large industrial pipes is presumably only for the function of preventing corrosion.
Functional coatings may be applied to change the surface properties of the substrate, such as adhesion, wet ability, corrosion resistance, or wear resistance.

*This study includes metallographic preparation procedure of coated & painted samples for making layer thickness measurement.

Different kinds of automotive part will be investigated
1. Air bag cover
2. Control panel frame
3. Steering wheel
4. Brand Logo

SAMPLE PREPARATION PROCESES

Samples are fixed on MICRACUT 202 as shown in the below photos with the help of GR 0548 clamping vise with GR 0400. Low feed-rate value adjusted to prevent coating layers during the operation.

Number 1,2,4 samples are cut with DIMOS diamond blade.

Operation parameters are following;

Table feed-rate : 50 µ / sec.
Disc speed : 2000 rpm
Travel : 15-40 mm
Force : 3A

After cutting operation sample 1,2,4 pieces mounted with cold mounting powder DMT 20(29 511)

Grinding & polishing operation made with FORCIPOL 102 + FORCIMAT 52 system.

The operation parameters and consumable list are following for samples.

1,2,4 samples

	Surface	Abrasive	Lubricant	Force Per Sample (N)	Time Min.	Disc Speed Rpm.	Head Speed Rpm.
Grind. Step 1	DEMPAX 38-040-600	600 grit SiC	Water	30 N	2 min.	200 CCW	100 CW
Grind. Step 2	DEMPAX 38-040-1200	1200 grit SiC	Water	30 N	2 min.	250 CCW	100 CW
Final Grinding	DEMPAX 38-040-2000	2000 grit SiC	Water	25 N	2 min.	200 CCW	100 CW
Polishing Step 1	METAPO-B 39-033-250	DIAPAT-M 3µ 39-420-M	DIAPAT [39-502]	25 N	5 min.	200 CCW	75 CCW
Polishing Step 2	FEDO-1 39-065-250	DIAPAT-M1µ 39-410-M	DIAPAT [39-502]	25 N	4 min.	150 CCW	75 CCW
Final Polishing	COLLO 39-085-250	COL-K(NC) 39-600	-	15 N	2 min.	50 CCW	50 CCW

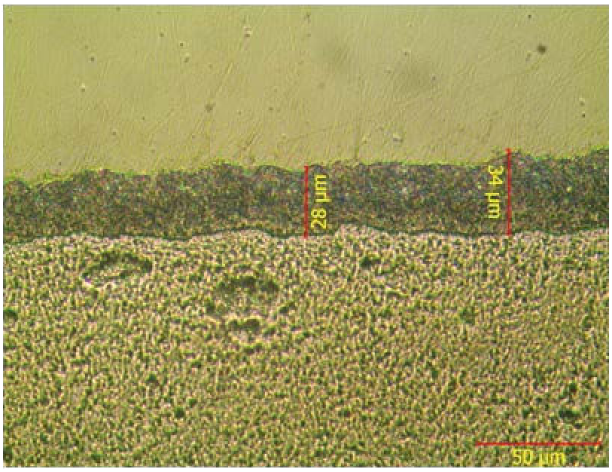
3. sample

	Surface	Abrasive	Lubricant	Force Per Sample (N)	Time Min.	Disc Speed Rpm.	Head Speed Rpm.
Grind. Step 1	MAGNETO 54 38-040-54	Diamond 54 µ	Water	20 N	2 min.	250	100
Grind. Step 2	MAGNETO 18 38-040-018	Diamond 18 µ	Water	25 N	2 min.	250	100
Final Grinding	MAGNETO 6 39-040-006	Diamond 6 µ	Water	25 N	2 min.	200	100
Polishing Step 1	METAPO-B 39-033-250	DIAPAT-M 3µ 39-420-M	DIAPAT [39-502]	25 N	5 min.	150	50
Final Polishing	METAPO-V 39-043-250	DIAPAT-M 1µ 39-410-M	DIAPAT [39-502]	20 N	3 min.	150	50

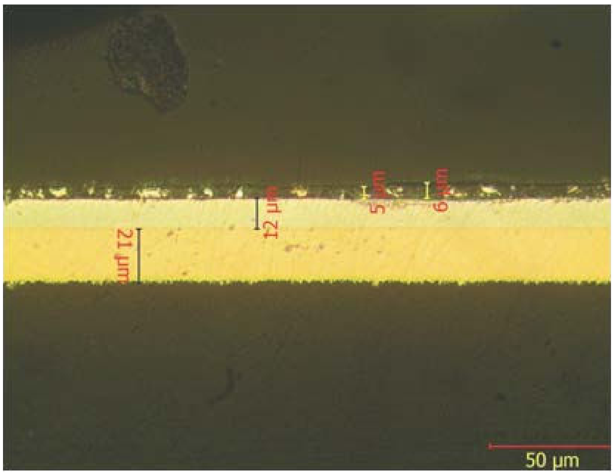
RESULT

After metallographic preparation, the layer thickness measured with Metallographic microscope and IMAGIN system.

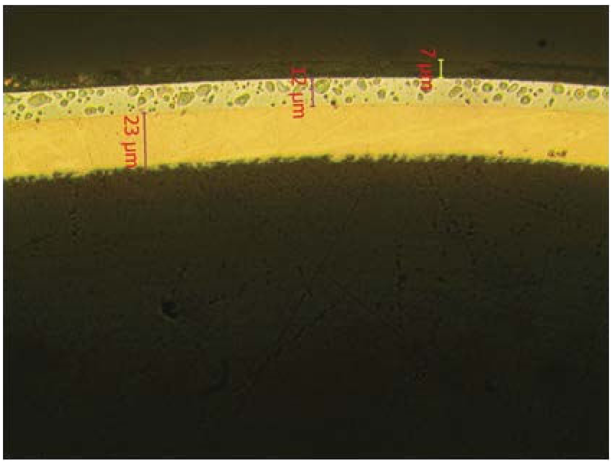
According to micro observation coating/painting layers can be seen below;



Sample 1 500 x



Sample 4 500 x



Sample 2 500 x

9. METALLOGRAPHIC PREPARATION OF MOTOR PISTON

INTRODUCTION

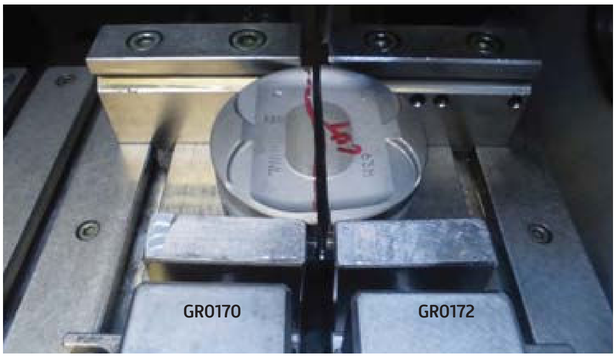
A piston is a cylindrical engine component that slides back and forth in the cylinder bore by forces produced during the combustion process. The piston acts as a movable end of the combustion chamber. The stationary end of the combustion chamber is the cylinder head. Pistons are commonly made of a cast aluminum alloy for excellent and lightweight thermal conductivity. Thermal conductivity is the ability of a material to conduct and transfer heat. Aluminum expands when heated, and proper clearance must be provided to maintain free piston movement in the cylinder bore. Insufficient clearance can cause the piston to seize in the cylinder. Excessive clearance can cause a loss of compression and an increase in piston noise.

Piston features include the piston head, piston pin bore, piston pin, skirt, ring grooves, ring lands, and piston rings. The piston head is the top surface (closest to the cylinder head) of the piston which is subjected to tremendous forces and heat during normal engine operation.

Requested sample and cutting line.

SAMPLE PREPARATION PROCESES

The sample is fixed on SERVOCUT 302 as shown in the below photos with GR 0170 & GR 0172 Quick acting clamping vise and cut manual cutting with Z axis.



Mounting parameters are;

Equipment : Ecopress 102
Heating Temperature : 190 °C
Pressure : 250 bar
Heating Time : 3 mins.
Cooling Mode : Standard Cooling
Cooling Temperature : 35 °C
Mounting Powder : DAP (29-012)

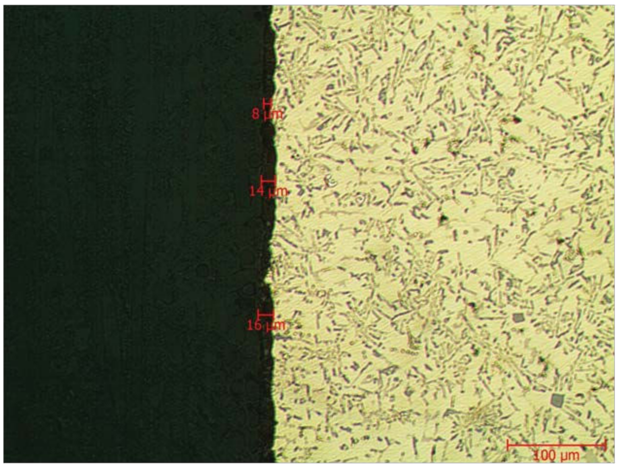
Equipment FORCIPOL 102 + FORCIMAT 52 grinding and polishing parameters are, show as below .

	Surface	Abrasive	Lubricant	Force Per Sample (N)	Time Min.	Disc Speed Rpm.	Head Speed Rpm.
Grind. Step 1	MAGNETO 54 38-040-54	Diamond 54 µ	Water	10 N	1 min.	200 CW	100 CCW
Grind. Step 2	MAGNETO 18 38-040-018	Diamond 18 µ	Water	10 N	1 min.	200 CW	100 CCW
Final Grinding	DEMPAX 38-040-2000	2000 Grit SiC	Water	2 N	2 min.	200 CW	100 CCW
Polishing Step 1	METAPO-B 39-033-250	DIAPAT-M 3µ 39-420-M	DIAPAT [39-502]	5 N	5 min.	200 CW	100 CCW
Final Polishing	FEDO-1 39-065-250	DIAPAT-M 1µ 39-410-M	DIAPAT [39-502]	4 N	4 min.	200 CW	100 CCW

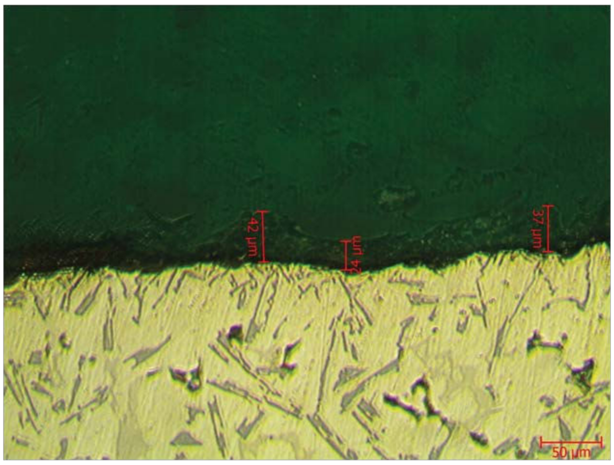
*Etching with KELLER solution.

RESULT

Microstructre photos are shown below;



200 x

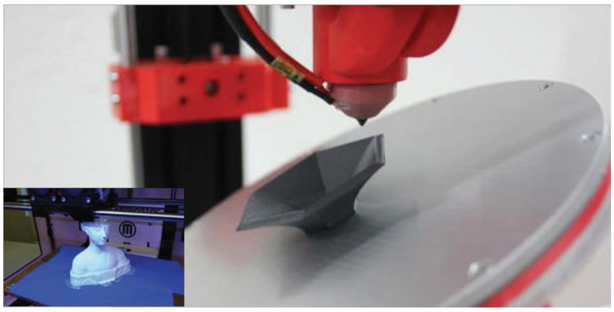


500 x

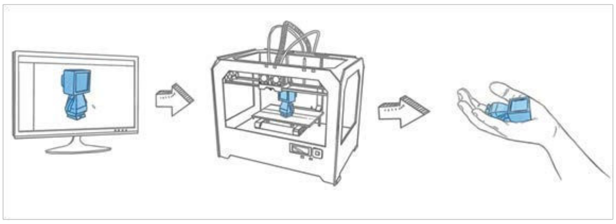
10 PREPARATION OF 3D PRINTED ALUMINUM

INTRODUCTION

3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file.

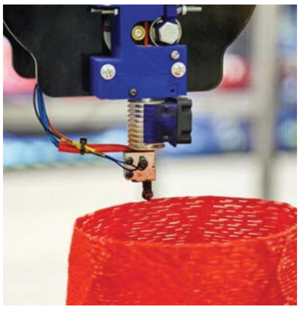


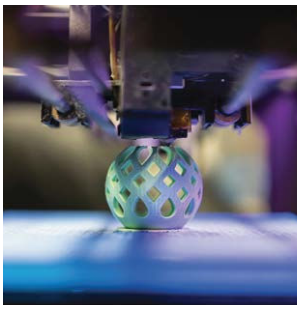
The creation of a 3D printed object is achieved using additive processes. In an additive process an object is created by laying down successive layers of material until the object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object.



3D printing is the opposite of subtractive manufacturing which is cutting out / hollowing out a piece of metal or plastic with for instance a milling machine.

The 3D printing industry encompasses many forms of technologies and materials. When most people think of 3D printing they are thinking of a simple desktop FDM printer but that's not the entire picture. 3D printing can be divided into metal, fabrics, bio and a whole host of other industries. For this reason, it's important to see it as a cluster of diverse industries with a myriad of different applications.

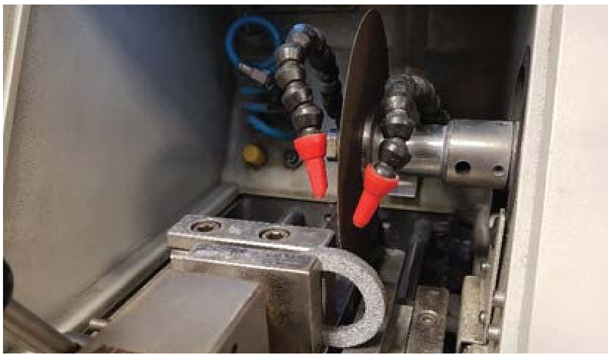


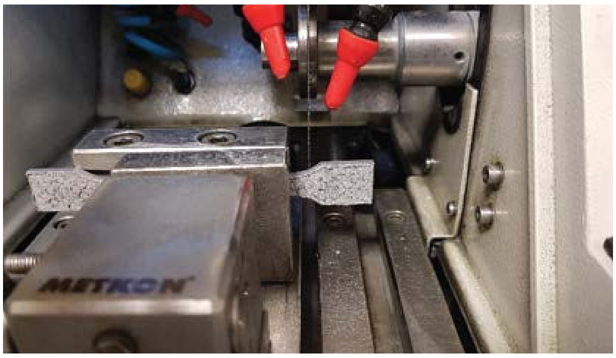


Samples will be prepared as metallographic purpose:

SAMPLE PREPARATION PROCESES

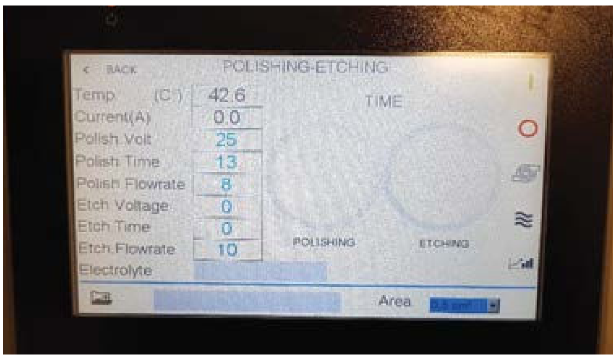
First, samples were clamped with the help of GR 0548 clamping device and fix to the MICRACUT 202 table.





Cutting Parameters: **Feedrate :** 100 µm/sec **RPM :** 2800 r/min.

Samples was grinded manually until 2500 grit for 30 sec each per step. After the manually grinding, sample ready for electropolishing operation with ELOPREP 102.



Electropolishing parameters and type of electrolyte can be seen below:
Polish. Voltage : 25 V
Polish. Time : 13 sec.
Polish. Flowrate : 8

Prefered electrolyte : 200 ml. Perchloric acid + 800 ml. Ethanol

RESULT

100 x

metkon
Technology behind Specimen

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