Metkon Application Note

Automatic Polishing operation of Aluminum samples

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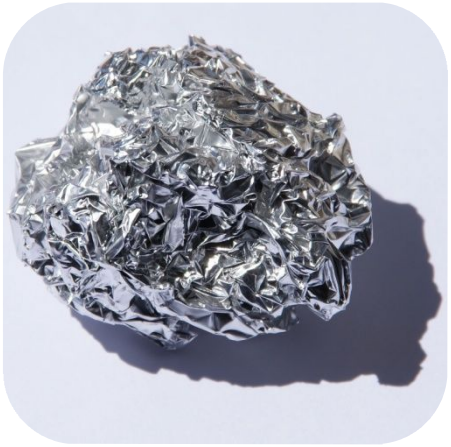
metkon
Technology behind Specimen

INTRODUCTION

Aluminum is a chemical element in the boron group with symbol Al and atomic number 13. It is a silvery-white, soft, nonmagnetic, ductile metal. Aluminum is the third most abundant element (after oxygen and silicon), and the most abundant metal in the Earth's crust. It makes up about 8% by weight of the crust, though it is less common in the mantle below. Aluminum metal is so chemically reactive that native specimens are rare and limited to extreme reducing environments. Instead, it is found combined in over 270 different minerals.[1] The chief ore of aluminum is bauxite.



Aluminum is remarkable for the metal's low density and for its ability to resist corrosion due to the phenomenon of passivation. Structural components made from aluminum and its alloys are vital to the aerospace industry and are important in other areas of transportation and structural materials. The most useful compounds of aluminum, at least on a weight basis, are the oxides and sulfates.

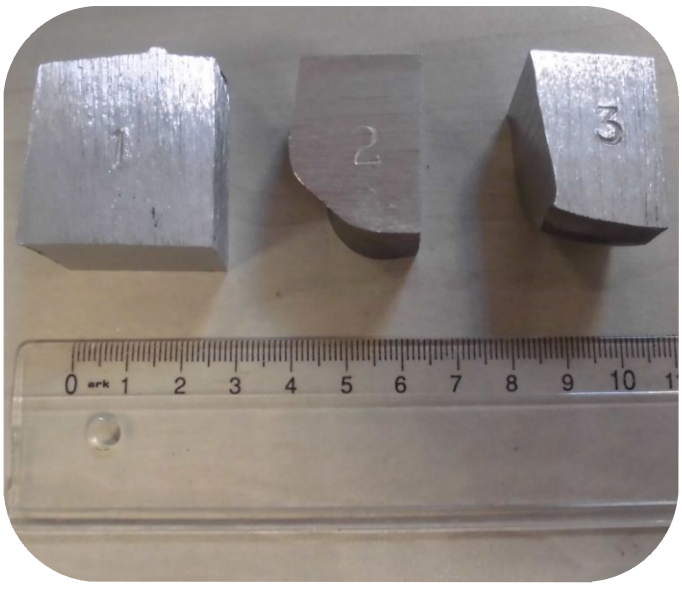
Despite its prevalence in the environment, no known form of life uses aluminum salts metabolically. In keeping with its pervasiveness, aluminum is well tolerated by plants and animals.[1] Owing to their prevalence, potential beneficial (or otherwise) biological roles of aluminum compounds are of continuing interest.

Aluminum is the most widely used non-ferrous metal Global production of aluminum in 2005 was 31.9 million tons. It exceeded that of any other metal except iron (837.5 million tons). Forecast for 2012 is 42–45 million tons, driven by rising Chinese output.

Aluminum is almost always alloyed, which markedly improves its mechanical properties, especially when tempered. For example, the common aluminum foils and beverage cans are alloys of 92% to 99% aluminum. The main alloying agents are copper, zinc, magnesium, manganese, and silicon (e.g., duralumin) and the levels of these other metals are in the range of a few percent by weight.

There are two kind of Al sample group. A group has mounted (Ø30) and the other group has not mounted.

Group 1



Group 2

APPLICATION REQUIREMENTS

DIGIPREP 251

Programmable with coloured 5,7" HMI touch screen control, with Siemens PLC control unit. Base Unit with large 0,75HP Motor, Variable wheel speed 50-600 rpm, Quite belt drive, Complementary or Contra rotational direction, Soft Start and Stop function, Retractable water hose, with water supply and drain tubes. sample preparation parameters, central and/or individual force application, steel mounting column, with variable specimen holder speed 50-150 rpm, 100 Watt DC motor, LED lighting, quick-locking swing mounted design, audible warning signal, with holding chuck. Air supply tubes, Complete and ready for operation. Without Specimen Holders.
230 V, 1-phase, 50 Hz.
Includes working kit "250 mm Aluminium wheel and splash guard",
Includes the following standard set of consumables;
*Special Magnetic Foil, Ø 250 mm.
*Thin Metal Plate(1 pcs), Ø 250 mm
*Magneto grinding disc 18 mic., 250 mm dia.
*An assortement of 5 polishing cloths 250 mm dia.
*Diamond suspensions one of each of 6 mic. and 1 mic., plus lubricant

	Order Code	Description
Equipment Used	45 03	DIGIPREP 251 Grinding & Polishing System
Equipment Accessories	31 22	Aluminum wheel, 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.)

LEVOMAT

Specimen Loading Fixture, to level the specimens within the central force specimen holders, without specimen loading plate.

	Order Code	Description
Equipment Used	45 60	LEVOMAT
Equipment Accessories	45 10	Specimen Loading Plate ø 130 mm
	45 20	Specimen Loading Plate ø 145 mm
	45 12	Clamp type specimen holder,Ø130mm, 6 specimens with Ø30 mm.
	45 25	Clamp type specimen holder, Ø 145 mm for 6 rectangular specimen 25 X 32 mm.

**Before the polishing operation, number 1 of group 2 has cut and sample were brought to the appropriate size for specimen holders. Then sharp edges were softened with the SiC grinding paper.*

Firstly, with the help of LEVOMAT specimens have clamped.

The polishing operation have been made with DIGIPREP 251 machine by using following parameters;

	Surface	*Abrasive*	*Lubricant*	*Force per Sample, (N)*	*Time (min.)*	*Disc speed (rpm) Rotation*	*Head Speed (rpm) Rotation*
Grinding Step 1	*DEMPAX* [38-040-240]	240 grit SiC	Water	80 N	2 min.	250 *CW*	*100 CW*
Grinding Step 2	*DEMPAX* [38-040-600]	600 grit SİC	Water	80 N	2 min.	250 *CW*	*100 CW*
Final Grinding	*DEMPAX* [38-040-1200]	1200 grit SiC	Water	80 N	2 min.	250 *CW*	*100 CW*
Polishing Step 1	*METAPO-P* [39-013-250]	*DIAPAT-M 6µ* [39-430-M]	*DIAPAT* [39-502]	100 N	3 min.	150 *CCW*	*75 CW*
Polishing Step 2	*FEDO-1* [39-065-250]	*DIAPAT-M 1µ* [39-410-M]	*DIAPAT* [39-502]	100 N	3 min.	150 *CCW*	*75 CW*
Final Polishing	*COLLO* [39-085-250]	*COL-K(NC)* [39-600]	*Colloidal Silica*	30 N	2 min.	100 *CCW*	*50 CW*

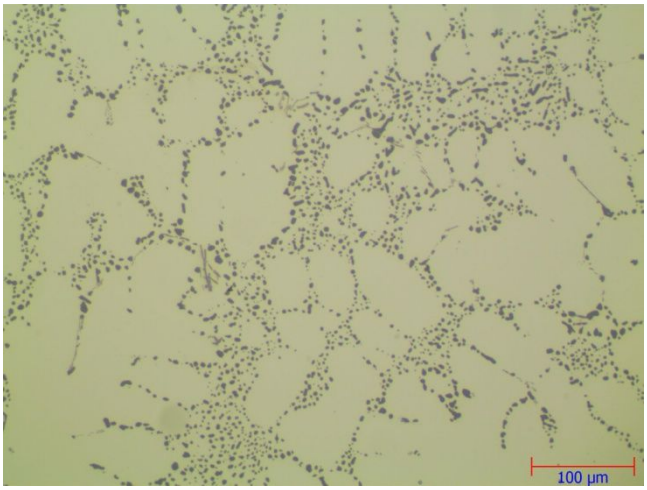
**Force was reduced by half when the Group 2 preparing in order to avoid tearing paper (Except for Final polishing step)*

RESULT

Microstructure photos of polished surface can be seen below:

GROUP 1

NO 1:



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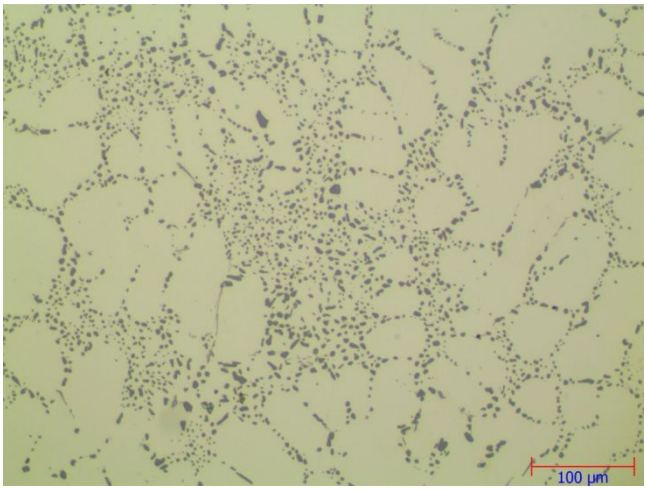

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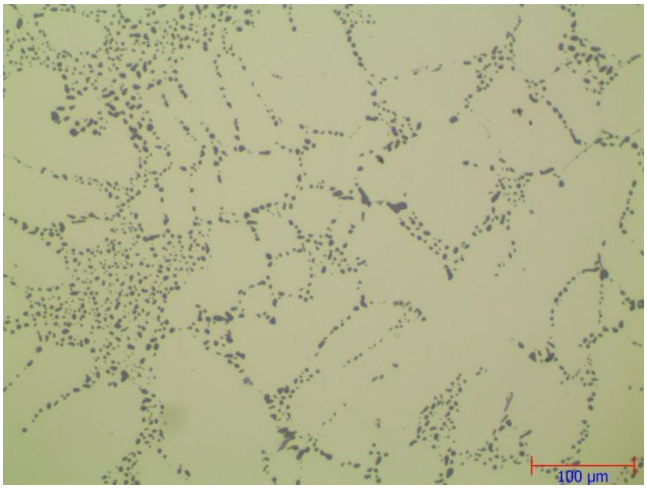

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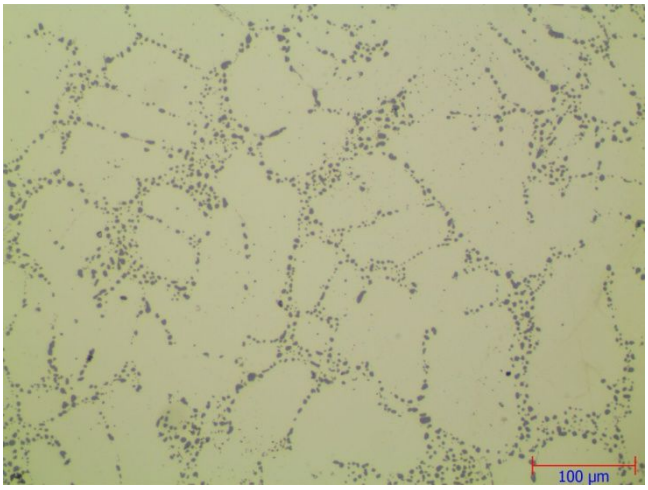

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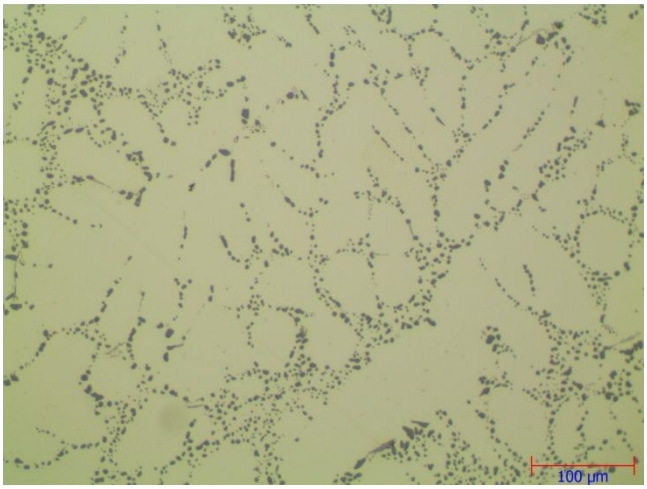

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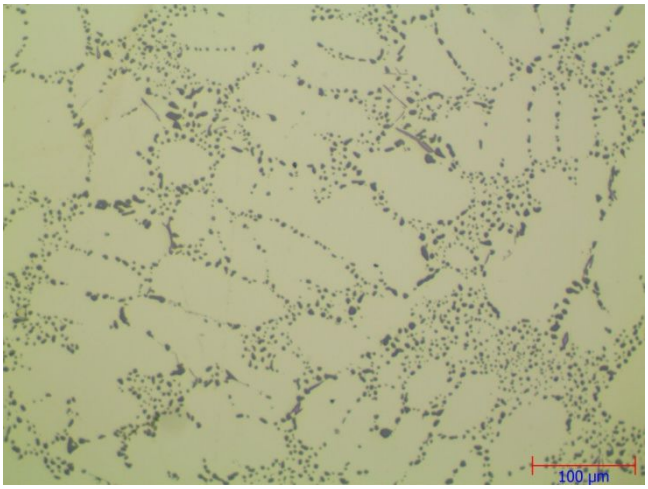

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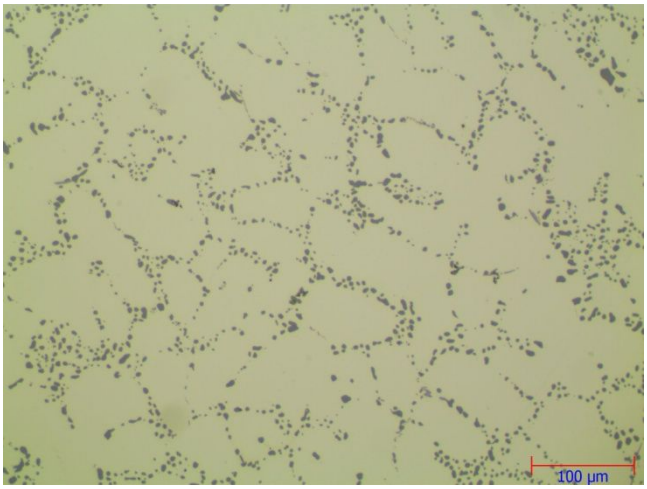

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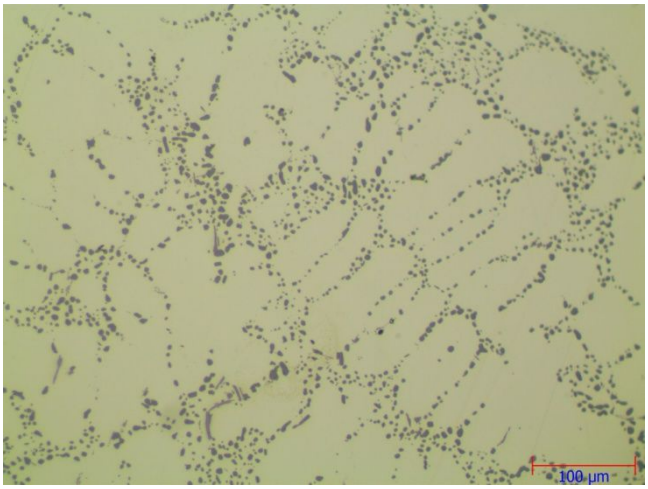

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GROUP 2

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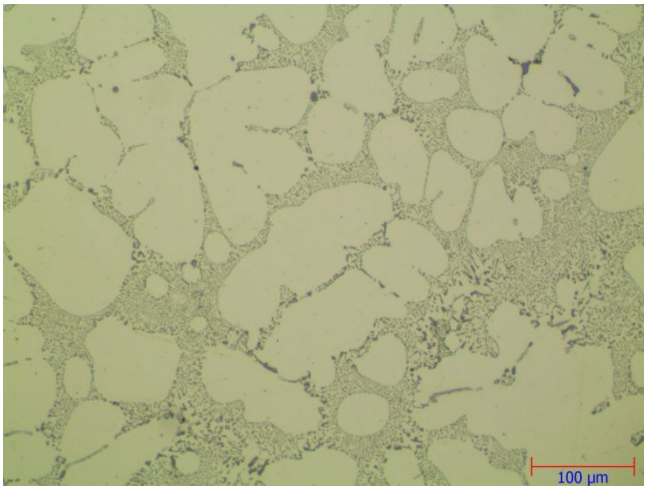

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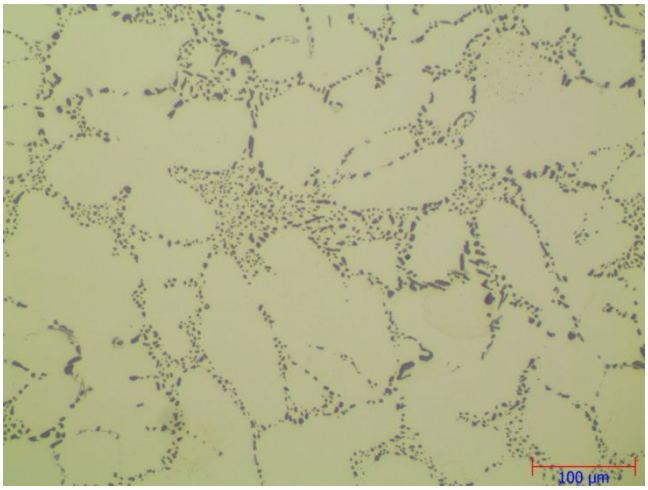

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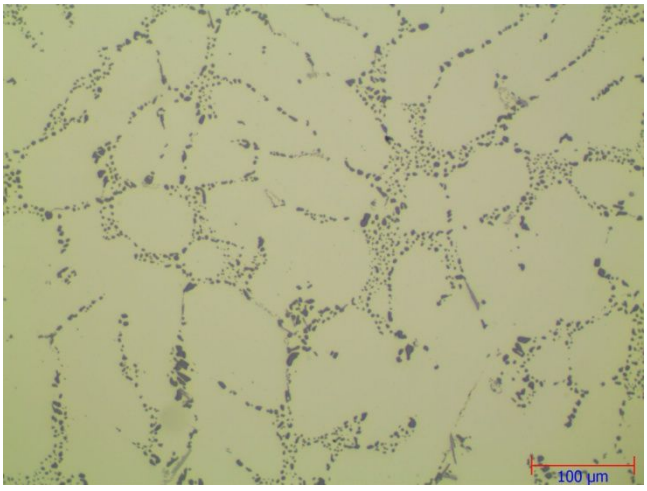

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