In the present paper, we have performed experimentally the tensile deformations of a Zn-22wt%Al alloy in a silicon oil bath. We analyze the local deformation and evaluate the superplastic properties at the divided small part in a specimen. The temperature changes at the small parts are also measured during the deformation. The local deformations increased with decrease of the strain-rate and increase of the test temperature, the necking diffused widely in the whole gauge length and the superplastic deformation became more suitable. When the specimen was deformed at a higher strain-rate, the speed of the temperature increase became higher.

**P12: Grain Refinement of Al-Mg Alloy by Ball Drop Method**

M. SAEKI, K. FUNAMI, Chiba Institute of Technology; M. NODA, JRSE Ltd., E-mail: g0471024@cc.it-chiba.ac.jp

Some methods for grain refinement of metal to improvement in mechanical properties are used. As one of them there are severe plastic deformation processes, which gives severe plastic deformation and is recrystallized into material. However, by the usual severe plastic deformation processes, even if it can desire improvement in strength, these techniques may cause the fall of toughness or elongation. Then, to make grain refinement only near the surface of material, the technique using impact load is effective as the method of the ability to maintain toughness into material inside. This research examines the optimal condition aiming at the grain refinement by ball drop test. As the results, in order to make it more fine grained, it was effective to repeat ball dropping at same position. Compared with one loading in ball drop test, it fined to the grain size below a One-quarter after 7 drop loading traial at same position.

**P13: Effects of Manganese Contents on Extruded AZ System Magnesium Alloys**

S. YOSHIDA, T. MURAI, Sanyo Alinum Industry Co., Ltd.; S. MATSUOKA, Toyama Prefectural University, E-mail: sh-yoshida@shdg.co.jp

Effects of manganese content in AZ31 and AZ10 on billets microstructures, extrusion loads, surface appearance, mechanical properties and extrusions microstructures were investigated. In the range 0 to 0.8% manganese content, there exist a adequate manganese content for avoiding surface cracks and obtaining proper mechanical properties.

**P14: High Speed Welding Technique with Very Thin Aluminum Sheet**

T. MASUKO, Tokyo Metropolitan Industrial Technology Research Institute; K. KOKUBO, S. UKITA, Kagakuin University, E-mail: Tomoki_Masuko@member.metro.tokyo.jp

In this experiment, ordinary inverter controlled TIG welder has been used. In order to be concentrated arc, polarity is DCEN and thin electrodes of 1.6 mm in diameter have been used. Maximum welding speed has been set until V=30000 mm/min. Aluminum sheets of 0.3 mm thickness have been clamped between copper plates to reduce weld heat flow of arc what causes deformation for preceding area. As welding speed becomes high, arc is dragged backward to weld bead, and it tends to become unstable. Therefore, dragged arc has been controlled by magnetic field of magnetic flux density B=0.02 Wb/m² with electromagnetic. The tip shape of electromagnet has been used rectangular type, and inclination angle β has been adopted 60 degrees. Besides, torch angle of γ=5 degrees and electrode of 2% CeO2-W material have been applied effectively. Consequently, butt welding of 0.3 mm in thickness aluminum sheets has been becoming possible at high welding speed V=30000 mm/min with these welding processes.

**P15: Development of Micro-inductors by Superplastic Forming of Metallic Glass**

M. KOBAYASHI, Y. SAOTOME, T. ISHITANI, S. FURUSAWA, H. SAKURAI, Gunma University; T. FUKUNAGA, Tokyo Parts Industries, E-mail: saotome@me.gunma-u.ac.jp

We have designed and fabricated a micro-inductor which is used for such as a hybrid electric circuit of a mobile phone. The dimension of the component is 0.36x0.25 mm and the width of coil is 10 micrometers. The component was fabricated by superplastic die-forging of Pt-based metallic glass. The material exhibits Newtonian viscous flow in the supercooled liquid temperature range between the glass transition and the crystallization point. The working temperature was 540K, since a polyimide film was selected as a die material due to its good mechanical property at the elevated temperature and precision machinability. The die was fabricated by image projection method of excimer laser micro-machining system and very smooth die surface was fabricated. The laser ablation machining was carried out with a photomask of the shape of the micro-inductor. The photomask was fabricated by lithography system. With this die, superplastic die-forging of the metallic glass was carried out and micro-structures of micro-inductor were fabricated at once. These fabrication processes demonstrate the advantages of metallic glasses and the superplastic microforming techniques for mass producing micro/nano machine parts or devices.

**P16: Development of a Palmtop Wear Testing Machine and the Characteristic of Ni-based Metallic Glass**

J. HATCHO, N. OKAMOTO, Y. SAOTOME, Gunma University, E-mail: saotome@me.gunma-u.ac.jp

Metallic glass is one of the most promising materials to fabricate micromachine components. Very recently, micro precision gears were fabricated by a high pressure die-casting and exhibited a long life due to good wear resistance[1]. Since, in the present study, we developed a palmtop, pin-on-disc type wear testing machine to explore the characteristics. The machine is 155 mm in length and 160 mm in width. The machine facilitates a holder of a pin specimen of 0.5 or 1 mm diameter, a turning table for a disc specimen of 25 mm in diameter and measurement system for friction force and sliding distance. Wearing surfaces are in-situ observed and measured with a laser-three-dimensional-microscope to evaluate the wear rate. Ni-based metallic glass(amorphous alloy) and tool steel SK4 were selected for the specimen. The metallic glass exhibited good wear resistance.

**P17: Superplastic Nanoforming of Optical Components of Metallic Glass**

Y. FUKUDA, K. SAKAGEN, Y. SAOTOME, Gunma University, E-mail: saotome@me.gunma-u.ac.jp

Metallic glasses are useful for fabricating nanodevices due to their viscosity and homogeneity on nanometer scales. In this study, we developed optical components of metallic glasses by superplastic nanoforming. Metallic glasses exhibit Newtonian viscous flow in a supercooled temperature range between the glass transition temperature and the crystallization temperature. This study used Pt-based metallic glass with a glass transition temperature of 502 K. This material was applied to reflective interference optical components, and a diffraction grating (1 micrometer interval) and a hologram were fabricated by superplastic nanoforming. Dies were made by Ni-electroforming, with master models fabricated by photolithography of the interference pattern. The working temperature of Pt-based metallic glass was 540 K under a compressive stress of 10 MPa. The results demonstrated the advantages of the superplastic nanoforming technique on metallic glass and for mass production of optical components.

**P18: Development of Material Wear-property in Homogenizer and Wear Characteristic Evaluation**