Introduction of JSPE Young Engineer Awards 2015

1. Makoto TANO (JTEKT Corporation)
High Precision Grinding of Eccentric Workpiece using Profile Error Prediction Method Based on In-process Measurement of Dynamic Pressure by Coolant
The grinding method, which has been developed in order to shorten the total machining time, has reduced profile error in rough grinding of eccentric workpiece by 30% than that of conventional method. In conventional rough grinding of eccentric cylinder, profile error due to variation of workpiece deflection in phase and due to displacement by own weight, has caused long finishing time. With the developed method, profile error is improved by compensating from the predicted value based on measurement of coolant dynamic pressure. Therefore, the JSPE Young Engineer Award is presented for this achievement.

2. Yu ZHANG (Ritsumeikan University)
Development of Drum-type Electroplating Equipment for Manufacturing Diamond Wire Tools
Diamond wire tools are widely used to slice silicon, sapphire, etc. In this study, drum-type electroplating equipment for manufacturing diamond wire tools was developed. Because the mechanism of drum-type equipment is unique, the depletion layer of nickel ion around the wires can be decreased during the electroplating process. In addition, multiple diamond wire tools can be manufactured simultaneously at high speed in one machine. The manufacturing costs of silicon and sapphire substrates can be reduced by using this electroplating equipment to manufacture diamond wire tools inexpensively. Therefore, the JSPE Young Engineer Award is presented for this achievement.

3. Ryuta NAKAMURA
(Akita Industrial Technology Center)
Development of Electric Field Non-contact Stirring Technology (EST) Applying an Abrasive Control Technique with the AC Electric Field for Immunohistochemistry along with Explication of the Rapid Mechanism
Conventional stirring technologies find it difficult to handle microdroplets on the order of nanoliters to microliters. A contamination-free and non-contact stirring technology was developed with a low increase in the solution temperature due to a stirring operation based on an abrasive control technique that adds an AC electric field to the droplets. The behavior of the microdroplets under an electric field was observed experimentally, and the effects of the applied voltage and applied frequency were clarified. These experimental results should be applicable to the medical examination, biotechnology, and industrial fields. Therefore, the JSPE Young Engineer Award is presented for this achievement.

4. Naoya KONAGAI (NTN Corporation)
Parallel-link High-speed Angle Control Equipment
Angle control equipment was developed that can quickly control the attitude by using a unique parallel-link mechanism with two degrees of rotational freedom, in contrast to the traditional rolling or fixed linear type. We developed a drive mechanism and control algorithm to improve the speed and position accuracy. This equipment can be expanded to the grease dispensation process, which requires a fast takt time, and the automatic welding process, which requires fine motions. Using this equipment should enhance productivity. Therefore, the JSPE Young Engineer Award is presented for this achievement.

Introduction of JSPE Takagi Awards 2015

1. Precise mechanical polishing of brittle materials with free diamond abrasives dispersed in micro-nano-bubble water
Hideo AIDA (Namiki Precision Jewel Co., Ltd., Kyushu University), Seong-Woo KIM, Kenjiro IKEJIRI (Namiki Precision Jewel Co., Ltd.), Toshiro DOI, Tsutomu YAMAZAKI, Kiyoshi SESHIMO (Kyushu University), Koji KOYAMA, Hidetoshi TAKEDA and Natsuko AOTA (Namiki Precision Jewel Co., Ltd.)
Precision Engineering Vol.40,pp.81–86
We have studied the effects of using water containing micro-nano-bubbles (MNB water) as the solution in which the diamond abrasives with a mean diameter of 0.5 μm are dispersed for the polishing slurry used in the precise mechanical polishing (PMP) of brittle material of GaN. While the formation of small number of clusters of abrasives was seen in the MNB water, the abrasives were basically well dispersed, which were almost comparable to that in pure water with a dispersion agent such as ethylene glycol. Since flocculation was observed for dispersion in pure-water without the addition of the dispersion agent, it was found that MNBs have dispersion effect for micro-sized abrasive particles. Regarding the polishing properties of GaN substrate with the MNB

water based polishing slurry, we observed a remarkable increase in the removal rate with no additional surface or subsurface degradation. Additionally, we observed a significantly reduced SSD for chemically weak N-face of GaN substrate. It was suggested that these observed effects were most probably a result of the cluster formation in the MNB water and the chemical effect in relation to high energy generation through bubble collapse, respectively.

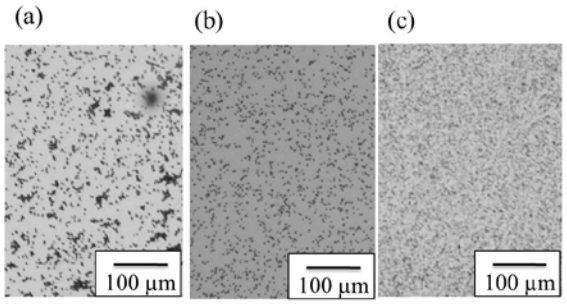

Fig.1 Optical microscope images of the slurries

2. Study on Design Method of Absorber for Controlling Chatter Vibration in Thin Plate Machining

Koji UTSUMI, Ippei KONO, Hideaki ONOZUKA, Tomu KATO (Hitachi, Ltd.) and Hiroyuki SASAHARA (Tokyo University of Agriculture and Technology)

J. JSPE Vol. 81 No. 2 pp. 187-192

This study aims to control chatter vibration of the large and thin flexible machining parts such as impellers by attaching dampers on the work piece in milling. These machining parts have so low stiffness that the chatter vibration is easily excited. Since the vibration decreases the productivity and machining accuracy, it is important to control the vibration by increasing the dynamic stiffness of the machining parts. In this research, a design method of the tuned mass damper (T.M.D) for suppressing the chattering by attaching same vibration characteristic dampers was proposed. The trial dampers which were optimized by using proposed method could decrease less than 57% of maximum amplitude of the impeller, and improved the roughness of the finished surface comparing with the case of without dampers.

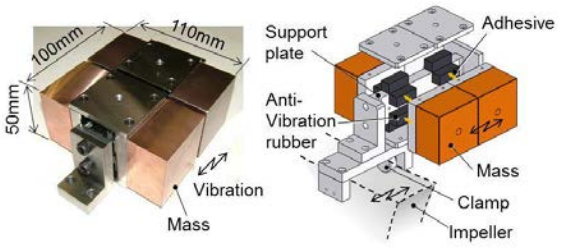

Fig.2 Schematic view of trial damper