



The Japan Society for Precision Engineering

Introduction of JSPE Young Researcher Awards 2010

1. Takato YAMAZAKI

Laser Induced Modification in Glasses by CW Laser Backside Irradiation (CW-LBI) - Platinum Implantation into Glass -

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We demonstrate metal particle implantation technique into glass plate by continuous-wave (CW) laser beam illumination. Platinum film with the thickness of $1\mu\text{m}$ was deposited on one side of Pyrex glass surface. The platinum film was radiated with a focused Ar ion laser beam from the other side of the glass. The laser power was set at 4.2W . As a result, the platinum film was melted and a platinum particle with the diameter of $5\mu\text{m}$ was implanted into the glass within 0.1s after the laser illumination. The glass around the platinum particle heated by the laser illumination was softened, which enables the platinum particle migration in the glass. Interestingly, the particle moved more than 3mm toward the light source with the speed of $\sim 0.2\text{mm/s}$. Energy dispersive X-ray spectroscopy (EDS) clarify that the particle was platinum, and silicon and oxygen, which were components of glass, were not detected. Trajectory of the platinum particle migration was modified and was able to be observed by an optical microscope. No platinum was detected in the trajectory of the platinum particle. The diameter of the modified zone was $\sim 10\mu\text{m}$.

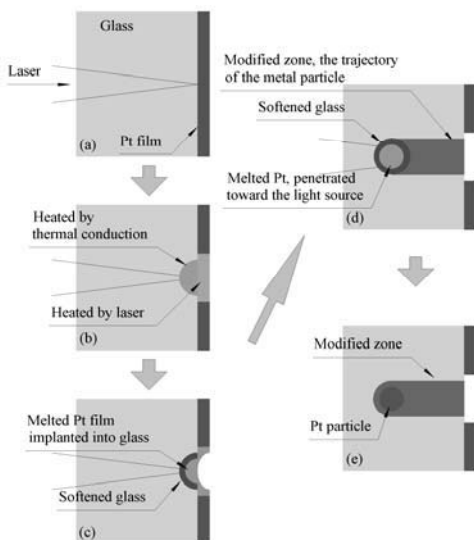


Fig. 1 Scheme illustrating the implantation of the platinum film into glass

2. Wataru HIJIKATA

A Disposable Magnetically Levitated Centrifugal Blood Pump for Extracorporeal Circulation Support - Improvement of Pump Performance for Animal Experiment -

J. JSPE, Vol. 76 , No. 9

A disposable magnetically levitated centrifugal blood pump, which aims to be used for from a few days to a few months, has been developed. An impeller is levitated and rotated without contact using a two-degree-of-freedom radial magnetic bearing and a magnetic coupling. Due to 'out-of-step' of the magnetic coupling caused by its insufficient transmittable torque, a previous prototype pump could not yield the required pressure-flow characteristics of 5 L/min against 106 kPa (800 mmHg). The magnetic coupling was redesigned in order to increase the transmittable torque. The stability of the impeller levitation against impact was evaluated through a base excitation test simulating animal experiment and practical use. Applying an impulse excitation of an acceleration of 200 m/s^2 , the impeller could keep contactless levitation both in the controlled direction and in the passively supported directions. Finally, the animal experiments for one to two weeks showed that no damage and no thrombus formation were found in the pump heads.

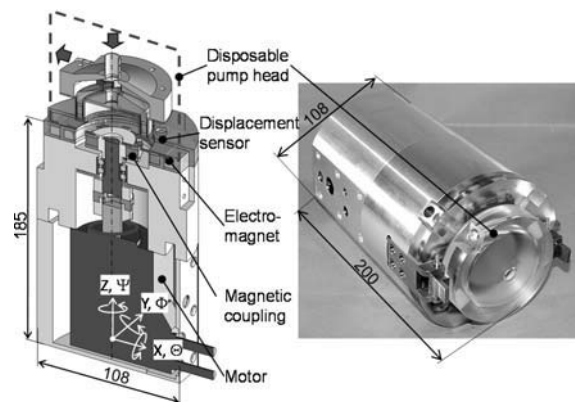


Fig. 2 Configuration and photograph of the pump

3. Masahito KIMORI

Miniaturization of Micro EDM Using Electrostatic Induction Feeding Method

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This paper describes the limit of miniaturization of micro EDM using the electrostatic induction feeding method. In this method, it is possible to minimize the influence of the stray capacitance existent parallel to

the working gap because the point of electric feeding can be located near the working gap. Hence, the minimum discharge energy is smaller than that of the relaxation pulse generator. As a result, the diameter of discharge craters of this method was $0.4\mu\text{m}$, smaller than that of the relaxation pulse generator by $0.3\mu\text{m}$. Therefore, the minimum diameter of rods obtained using this method was $0.8\mu\text{m}$, smaller than that of the relaxation pulse generator by $0.1\mu\text{m}$. Moreover, the success probability of fabrication of micro rods thinner than $2.0\mu\text{m}$ in diameter was two times higher than that of the relaxation pulse generator.

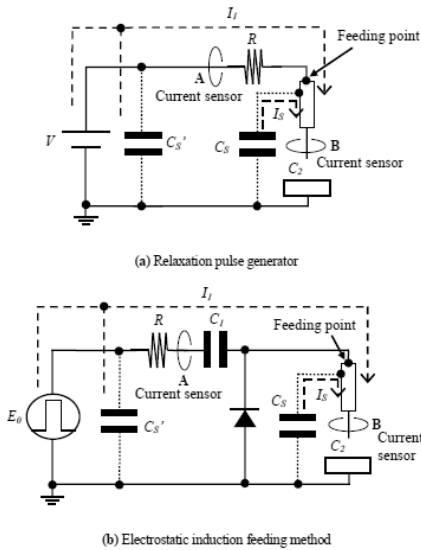


Fig. 3 Discharge circuit for minimizing discharge energy

4. Koji SHIMAMURA

High-efficiency and High-precision Machining of Difficult-to-machine Materials by PVD Coated Tools (1st Report) - Dry High-speed Milling of SUS304 with TiCN Coated End Mills Deposited by UBMS Method - J. JSPE, Vol. 76, No. 10

The UBMS (UnBalanced Magnetron Sputtering) method is applied to the coated end mills and some kinds of such tools are used in high-speed milling of SUS304. This coating film is designed to improve lubricating ability rather than heat resistance. TiCN film deposited by UBMS method (U-TiCN) has

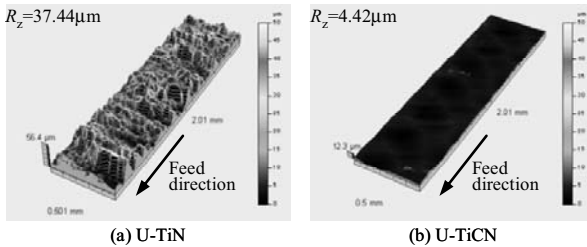


Fig. 4 3D profiles of workpiece surface

smooth surface and low coefficient of friction. XPS analysis reveals that the U-TiCN film includes many free carbons rather than carbide phases, and this structure acts as lubricant as well as thermoprotective film. Long tool life and good finished surface quality are obtained with U-TiCN coated end mills than standard commercially available coated end mills in high-speed side milling without coolant. An U-TiCN end mills having a low coefficient of friction suppress adhesion of workpiece material and overlap of chips to the cutting edge.

Introduction of JSPE Takagi Award 2010

Maintenance Planning in Re-entrant Flow Shop (2nd Report) - Application of Multi-start Greedy Method and Verification Test -

Yuuichi NONAKA, Attila LENGYEL, Yuuichi SUGINISHI, Kouichi SUGIMOTO, Rieko AIZAWA, Natsuko YANO, Masaki KATO, Toshiya KAIHARA, Nobutada FUJII and Takako KURANO (Hitachi, Ltd.)

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This paper presents an optimization method for facility maintenance scheduling in re-entrant flow shop using Multi-start and Greedy method. The proposed approach regards maintenances as jobs within limits of starting and finishing time, so that the schedule can realize not only proper maintenance to prevent facility troubles but also high productivity with short scheduling time. A case study is presented for a semiconductor manufacturing system, in which it is difficult to find a proper plan because of complex process flow so that the jobs often re-enter into the facilities. The feasibility of the proposal is discussed comparing to Lagrangian decomposition coordination method in the first; the proposed method can realize feasible solutions within acceptable calculation speed in real. Also, the feasibility is studied in a real semiconductor manufacturing system and confirmed the proposed method can gain its productivity.

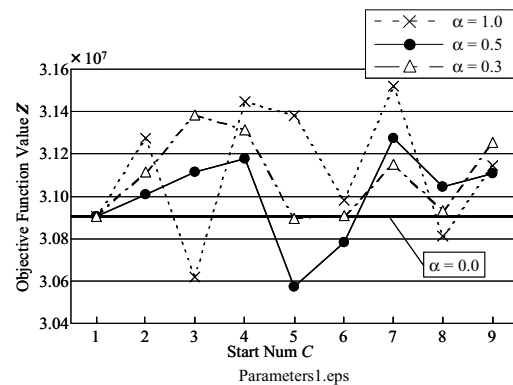


Fig. 5 Multi-start Greedy Effect ($\delta=1.0$)