ing of four finger 7075 alloys. Different die materials: preheated tool steel (~ 250°C), graphite and non-asbestos Sindanoy. The solidification behaviour was examined by numerical finite element model. The model was to provide the temperature distribution during solidification, to locate the shrinkage porosity, and to estimate the proper ejection time of the semi-solid product. The results show that thixoformed 7075 products produced by using Sindanyo die have the highest tensile properties due to the minimum of heat loss during solidification, resulting in completely die filling before solidification and the ending of freezing at the gate. * Sindanyo grade H61 has a substrate of high Alumina cement with selected fibres to give good strength at elevated temperature.

**CAS-09: Production of AZ31 Magnesium Alloy Strip in Melt Drap Process with Forming Roll**

S. NISHIDA, T. YAMAZAKI, N. ISHIKAWA, M. MOTOMURA, Waseda University.
E-mail: shinichi-nishida@toki.waseda.jp

Melt Drap process is one of many rapid cooling solidification methods using a single roll. We produced magnesium alloy AZ31 strip by the MD process with a forming roll. First, a strip whose surface was solidified freely by the process without a forming roll was produced. Roll Speed was varied between 30, 50 and 90 m/min. Pouring Temperature was varied between 660, 700, 740 and 780°C. Good strip was produced with all the experimental conditions. Average grain size was 48μm. Then a strip with a surface formed by the process with forming roll was produced. Gap between the rolls was varied depending on strip thickness obtained by process without a forming roll. The surface of the strip was improved. The grain refined significantly near the surface which was formed by a forming roll, and the average grain size was 8μm, but some defects were generated.

**CAS-10: Optimisation of Runner System to Minimise Defects in Aluminium Casting Process**

S. JAMROONRAT, S. PITA KTHAPANAPHONG, King Mongkut’s Institute of Technology North Bangkok.
E-mail: sp@kmitnb.ac.th

This work investigates the design of runner system on minimising defects in an aluminium casting process. Aluminium casting has been one of the fundamental materials processing methods used in various industries including construction, machine tools and particularly in automotive industries. The problems often encountered in casting include poor quality of the cast parts. Various types of defects are sometimes developed at different locations within the cast products. This work examines the effects of runner system design on minimisation of such defects during casting using a simulation technique. Different types of defects at various locations are examined. Parametric study is carried out in order to optimise the design of the runner system. Design guidelines are proposed.

**MEP-01: A Novel Polishing Method using Abrasive Dispersion Typed Functional Fluid**

Y. AKAGAMI, Akita Pref.Ind.Tech.Center; M. MURAOKA, Akita University.
E-mail: akagami@akita-iri.pref.akita.jp

This paper shows that non-conductive specimen such as glass and semiconductors to polish with dispersion type functional fluid under AC electric field, a new multi-layered concentric electrode was introduced in this study. It can be observed that the motion of abrasives can be controlled by the AC electric field during polishing. Borosilicate glass plates were polished with the multi-layered concentric electrode. Surface roughness was reduced from 16.0 nmRa to 5.2 nmRa after 3min under optimum AC electric field as 2kV/mm of the electric field and 0.8 Hz of AC frequency, no use of polishing pad.

**MEP-02: The Effect of Ultrasonic Vibration for the Machining with Non-rotating Tool**

S. ITO, National Institute of Advanced Industrial Science and Technology, E-mail: Satoshi.ito@nii.aist.go.jp

The machining method using single cutting edge non-rotating tool can finish the work piece without the tool rotational direction scratch. However, the cutting speed is limited within the table feed speed. To increase the cutting speed, ultrasonic vibration was added on the cutting edge and the effect was examined. The ultrasonic vibration equipment was attached in the spindle head of a vertical type machining center. The vibration method was twisted type, vibration frequency was 27 kHz, and amplitude range was 5 to 30 micrometers. Observations of oscillating state of the cutting edge during the machining showed that the amplitude was decreased sharply. Addition of vibration made the cutting force decreased and a surface roughness improved, especially during dry cutting process. Within moderate amplitude of ultrasonic vibration, the residual stress of the machined surface changed to direction of compression stress with the increase of amplitude. However, unlike cutting force or surface roughness, if the amplitude was too large, the residual stress changed to an opposite direction. For acquiring a good residual stress state, it is effective to use the machining conditions to reduce cutting force rather than adjusts tool vibration amplitude or tool rake angle.

**MEP-03: Finite Element Investigation of Multi-Phase Transformation within Carburized Carbon Steel**

S.H. KANG, Y.T. IM, Korea Advanced Institute of Science and Technology (KAIST),
E-mail: yitim@kaist.ac.kr

Mechanical components for the automobiles, aircrafts and machines are required to have the higher strength, hardness and wear resistance, when these parts are generally subjected to the circumstance of high load and impact. Such mechanical properties can be obtained from the carburization and quenching processes. Thus, in this study, numerical investigation using three-dimensional finite element technique was made to simulate the carburization and multi-phase transformation processes within the carburized carbon steel during the quenching. In order to simulate the carburization process, the second Fick's equation and carbon diffusion equation were adopted. For numerical simulation of the diffusion phase transformation occurred during the non-isothermal quenching process, subdivision of the cooling curve into various small isothermal steps was introduced with the help of various TTT diagrams of carbon steel. In addition, Shell's additive rule and JMak's equation were also employed. On the other hand, Koistinen and Marburger's equation was used to model the diffusionless transformation. Through numerical analyses of carburization and quenching processes, the temperature and volume fraction of each phase were predicted for simple cylindrical specimen and complex geometries considering the latent heat generated during phase transformation. The numerical results were compared well with the data available in the literature.