

The environment surrounding the world, the change to Electric Vehicles and the impact on die casting industry

Session Chairperson : Nano-cast corporation Masao Kikuchi

Special lecture 1

Recent environmental regulations (mainly on EV regulation) in major countries and its impact for the die-casting industry

Nomura Research Institute Shoichiro Hara

I explain the automobile production volume (including the ratio of engine / xEV) in major countries and the new law or regulation centering for the EV. Furthermore, I will try to estimate the influence on the die casting industry by EV regulation. The worldwide production volume is growing with the market expansion of developing countries. It will be 100 million. The production volume of engine is the much higher than xEV now in the global environmental issue. However, EV regulations launched from European countries are spreading globally, including developing countries. I will try to estimate the influence on the die casting industry.

Special lecture 2

Automobile trends and Needs for Die Casting. Things to be mastered, changed and added accompanying automobile electrification

TOYOTA MORTOR CORPORATION Hidehiko Kadono

Automobile industries have been facing to the critical transition period once in 100 years because of electrified and self-driving cars. Diversity, safety and conformability in automobiles has been more and more necessary to be suitable for living environments in each country and supply the freedom of movement and the richness of life for more people. Light metal die casting has flexibility for product design, which has been contributed to lightweighting and stiffness improvement (NV enhancement) on powertrain units and vehicle as alternatives of iron structural components. Moreover, applying light metal components has been widely expected more than ever because battery weight will be added to vehicle weight with the transition to electrified cars. In this presentation, we consider added-value contributing future cars which die casting process will be able to give, while the other processes and materials such as Carbon Fiber Reinforcement Plastics (CFRP) has been widely adapted with overcoming the conventional difficulties.

Special lecture 3

Changes to Electric Vehicles and Expectations for Die Casting Technology

Nissan Motor Co., Ltd. Dr. Eng. Hiroshi Kambe

In order to solve global environmental problems, changes to electric vehicles are rapidly progressing. Many of die castings for automobile parts are applied to parts of engines and transmissions, so if they are replaced by electric motors, the impact on the die casting industry will be great. In addition, weight reduction of automobiles is also an important issue for improving fuel economy, and it is also required to apply die casting to parts that have not been used so far, contributing to weight reduction. In die casting process, it is possible to produce lightweight parts in large quantities at low cost, but many parts have not been applied in terms of performance and cost. In the future, it is important to apply it to parts that have not been applied conventionally or newly set parts by raising the characteristics of die casting. In this report, I will describe die casting technology required for future automotive parts application.

TECHNICAL PAPER PRESENTATION 11/8 (Thursday) **First venue F203~F206** ※ Auditing charge

Session Chairperson

Kyusyu Institute of Technology
Dr. Masahiko Hihara



JD18-1

Improving die life by PVD coating

Oerlikon Nihon Balzers Coating Co., Ltd.

● Takashi Osaki, Shigeo Fukui

With a growing need of automotive lightening, there is a great demand for Al die cast parts which is lighter and with high dimensional accuracy, as an alternative to steel parts. In order to improve the price competitiveness of Al die cast parts and increase its productivity, reducing the downtime and maintenance time by improving mold life-span is needed. The factors contributing to shortening mold life include seizure, heat check and erosion. We have been receiving a high valuation of BALINIT® LUMENA and

BALINIT® ALCRONA MODIFY, the coating technologies which realize longer lives of mold components, such as core-pin and insert. We are now presenting the achievements by applying our new coating procedure, BALINIT® FORMERA, which enables further life extension.

JD18-2

Characterization of Al₂O₃ coating prepared by plasma-enhanced chemical vapor deposition

Oriental Engineering. Co., Ltd.

● Dr. Kazuki Kawata, Toru Kidach, Motoshi Komatsu,
Yuta Seino

Aluminum oxide (Al₂O₃) coatings were prepared on steel specimens using pulsed d.c. plasma-enhanced chemical vapor

deposition (PCVD) in a mass-production type equipment. Various properties such as hardness, microstructure, crystal structure, tribological property and soldering and erosion resistance in a molten aluminum die-casting alloy of the specimens deposited Al2O3 coatings by PCVD were compared to those of untreated specimens, gas nitrided specimens and various coatings prepared by physical vapor deposition (PVD).

JD18-3

Characteristics of combined nitrided hot work tool steel

PARKER NETSUSHORI KOGYO CO., LTD.

● Haruna Ishizuka, Kosuke Takamura, Dr. Youichi Watanabe

Recently developed novel salt-bath nitrocarburizing can form a lithium-iron compound-oxide layer on the surface of steel in concurrence with a nitride layer by adding lithium ions to molten salt. The surface microstructure formed by the novel nitrocarburizing can improve the erosion resistance against aluminum and seizure resistance to a greater extent because the oxide layer by nitrocarburizing is much thicker and denser than the ferrous-oxide layer formed by post-oxidized treatment (i.e. oxidation after nitriding) which has been used for improving these resistances.

Larger depth of nitrided zone is in demand for some die and mold. Salt-bath nitrocarburizing takes long time to form deep nitrided zone and treatment for long time leads to detachment of the oxide layer on the surface. In this study, we investigated the surface microstructure and erosion resistance of hot work tool steel formed by combined nitriding which is carried out by using the novel nitrocarburizing after conventional nitriding. As a result, deeply nitriding zone and high erosion resistance could be achieved by combined nitriding.

JD18-4

Improvement of thermal fatigue resistance by nitriding treatment of strengthening the surface.

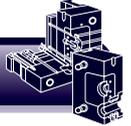
KANUC Corporation

● Shuichi Nakaso, Kaoru Akamatsu, Siori Endo, Hiroya Horikoshi

We introduce the idea of nitriding treatment with excellent thermal fatigue resistance. It was found that the resistance to thermal fatigue was improved by nitriding treatment by a new strengthening method incorporating a microscopic viewpoint this time. As a countermeasure against thermal fatigue which has been carried out in recent years, nitriding treatment has been known to be effective also in practice. However, the number of voices that desire to improve the function of countermeasures against thermal fatigue caused by nitridation has increased in recent years. It is known that nitriding treatment as means for improving thermal fatigue resistance is "it is desirable that the compound layer is small and the diffusion layer is thin". In this case, we obtained finer grasp of the diffusion layer and further extended the thermal fatigue life more than before by nitriding treatment which strengthens the vicinity of the surface even in the diffusion layer. Verification of Conventional nitriding method and its method were verified, so introduce it.

Session Chairperson

MINO INDUSTRY CO., LTD.
Hideto Sasaki



JD18-5

Examination of re-shotpeening for hot work tool steel SKD61

SINTOKOGIO, LTD. ● Dr. Eng. Yuji Kobayashi, Akinori Matsui

Shot peening is applied to auto motive parts and aero craft parts in order to improve the fatigue strength of metal material. It is sometimes used for die casting die to prevent heat checking on the die surface or cracks from water cooling holes. In our previous research, the initiation of heat check can be prevented by periodical shot peening (It is called re-peening after that). In order to obtain this effect sufficiently, it is expected that timing and number of re-peening will have a large effect. Therefore, the influence of re-peening processing timing and establishment of evaluation method are important subject. In this report, the fatigue test which is imitated die casting die is applied in order to evaluate re-peening.

JD18-6

Study on Cracking Mechanism at Cooling Holes in Die Casting Dies

Ahresty Corporation

● Masaki Miura (M.E.), Shin Orii, Shigeyoshi Komaki, Dr. Shunzo Aoyama

Ahresty Tochigi Corporation Mamoru Koshio

Ahresty Kumamoto Corporation Hiroaki Inoue, Hiroshi Sakamoto

Cracking mechanism at cooling holes in die casting dies was studied. It is thought that corrosion fatigue, i.e. the stress amplitude in corrosive environments causes the crack from cooling holes. The test method to simulate the crack was developed by means of a test piece for rotary bending fatigue test and evaluated various measures in order to prevent cracking at cooling holes. Also we reproduced the crack from a cooling hole in the actual die casting die and confirmed the validity of the results obtained in the developed test method. Some of the measures were applied to inner core cracked from cooling hole in mass production.

JD18-7

Quality and Suitability of Die Casting Die

Kyusyu Institute of Technology ● Dr. Masahiko Hihara

The quality stability for the die-casting die are influenced by thermal fatigue and creep properties by the heating-cooling thermal cycles and also by the erosion and washout with contacting molten metal. These phenomena greatly influence the quality stability and the life time for the die-casting die. A die steel, machining, applying electric energy processes (including electric discharge method, the welding processing), heat treatment and surface treatment are related to a factor of the quality stability and die life. In this report describes how to obtain a higher stability of the die casting die including an example.

Reception 11/8(Thursday) 17:30~19:00
2nd Floor Seaside RISTORANTE ATTIMO