



The 6th International Conference on Magnesium

Shenyang, China • September 23-26, 2017

PROGRAM & ABSTRACTS



<u>11:15-11:30</u>	Enhanced Corrosion Resistance and Biocompatibility of Magnesium Alloy by Mg-Al Layered Double Hydroxide <u>Feng Peng</u> , Xuanyong Liu <i>Shanghai Institute of Ceramics, Chinese Academy of Sciences</i>
<u>11:30-11:45</u>	Study on the Microstructure and Properties of Mg-Zn-Ca Alloy Clip for Biomaterial Application Maobo Zheng, <u>Debao Liu</u> , Guangquan Xu, Minfang Chen <i>Tianjin University of Technology, China</i>
<u>11:45-12:00</u>	Enhanced Corrosion Resistance of Mg Alloys by Predesigned Corrosion <u>Guosong Wu</u> ¹ , Xuming Zhang ² , Hao Wu ³ , Paul K. Chu ³ ¹ Hohai University, China; ² Wuhan University of Science and Technology, China; ³ City University of Hong Kong, China
Session 3	Chairs: Daolun Chen, Guangling Song
<u>13:30-13:50</u> Keynote	A High-Specific-Strength and Corrosion-Resistant Magnesium Alloy <u>Wanqiang Xu</u> <i>The University of New South Wales, Australia</i>
<u>13:50-14:10</u> Keynote	Thermal Diffusivity in Binary Mg-Re Alloys Chuangye Su, Dejiang Li, <u>Xiaoqin Zeng</u> <i>Shanghai Jiao Tong University, China</i>
<u>14:10-14:30</u> Keynote	Thermal Conductivity of Mg Alloys <u>Mingyi Zheng</u> <i>Harbin Institute of Technology, China</i>
<u>14:30-14:50</u> Invited	Elasticity Modulus and Damping in Some Novel Magnesium Alloys <u>Ali Arslan Kaya</u> <i>Mugla S.K. University, Turkey</i>
<u>14:50-15:10</u> Invited	Research of Squeeze casting technology of Al/Mg-Based Composite Materials <u>Hua Hou</u> , Liwen Chen, Yuhong Zhao, Jinzhong Tian <i>North University of China</i>
<u>15:10-15:25</u>	The Mg-Ni-Nd Hydrogen Storage Alloys with Long-Cycle Life <u>Qun Luo</u> , Qian Li, Kuo-Chih Chou <i>Shanghai University, China</i>
<u>15:25-15:40</u>	New Magnesium Alloys for High Temperature Application <u>Ning Mo</u> ¹ , Qiyang Tan ¹ , Bin Jiang ² , Fusheng Pan ² , Yuanding Huang ³ , Mingxing Zhang ¹ ¹ The University of Queensland, Australia; ² Chongqing University, China; ³ Helmholtz-Zentrum Geesthacht, Germany
<u>15:40-15:55</u>	Combined Influence of Be And Ca on Improving the High-Temperature Oxidation Resistance of the Magnesium Alloy Mg-9Al-1Zn <u>Qiyang Tan</u> ¹ , Ning Mo ¹ , Bin Jiang ² , Fusheng Pan ² , Andrej Atrons ¹ , Mingxing Zhang ¹ ¹ The University of Queensland, Australia; ² Chongqing University, China
<u>15:55-16:10</u>	Experimental Studying the Phase Equilibria in the Al-Rich Part of Al-Cu-Mg-Mn Quaternary System <u>Guoqiang Lin</u> , <u>Cuiyun He</u> , Jingxian Weng, Jianmin Zeng <i>Guangxi University, China</i>
Modeling & Simulation	
Session 1	Chairs: Chris Gourlay, Yong Du
<u>13:30-13:50</u> Keynote	Modeling of Multicomponent Magnesium Alloys by the CALPHAD Method <u>Fan Zhang</u> ¹ , Chuan Zhang ¹ , Shuanglin Chen ¹ , Rainer Schmid-Fetzer ² , Alan Luo ³ ¹ CompuTherm, USA; ² Clausthal University of Technology, Germany; ³ Ohio State University, USA
<u>13:50-14:10</u> Keynote	Thermodynamic and Thermophysical Databases for Multicomponent Mg Alloys and Design of Magnesium Alloys <u>Shuhong Liu</u> , <u>Yong Du</u> , HuiFeng, Kai Xu, Dandan Huang, Fan Zhang, Peisheng Wang, Kaiming Cheng <i>Central South University, China</i>
<u>14:10-14:30</u> Keynote	Three-Dimensional Phase Field Simulation and Ab-Initio Modeling Studies on the Growth Behavior of Magnesium Alloy Dendrites <u>Jinglian Du</u> , Zhipeng Guo, Manhong Yang, <u>Shoumei Xiong</u> <i>Tsinghua University, China</i>
<u>14:30-14:45</u>	Mechanism of Cross Slip of Pyramidal Plane in Magnesium Alloy <u>Hao Sun</u> ¹ , Wei Liu ¹ , Zhigang Ding ¹ , Dalong Zhang ² , Yonghao Zhao ¹ , Enrique J. Lavernia ² , Yuntian Zhu ¹ ¹ Nanjing University of Science and Technology, China; ² University of California, USA

hydroxides, Biocompatibility

Enhanced Corrosion Resistance of Mg Alloys by Pre-designed Corrosion

¹Guosong Wu, ²Xuming Zhang, ³Hao Wu, ³Paul K. Chu

¹Hohai University, China, ²Wuhan University of Science and Technology, China, ³City University of Hong Kong

Abstract: The application of magnesium alloys can reduce environment pollution and fuel consumption in automobile and aerospace industries because magnesium alloys are one of the lightest structural metals. In addition, magnesium alloys have attracted much attention in biomedical fields due to their natural biodegradation and low Young's modulus similar to that of human bones. However, rapid corrosion of magnesium alloys is undesirable in those applications. Usually, a simple way to resist the corrosion is to use a surface barrier layer isolating the bulk materials from the external environment. Here, we propose a new concept based on the design and control of pre-corrosion products to mitigate the aqueous corrosion. A pre-corrosion process of Mg-Al-Mn alloys in a hydrothermal condition is attempted and a uniform surface consisting of an inner compact layer and top Mg-Al layered double hydroxide (LDH) micro-sheets is produced. Ensuing surface modification with fluorinated silane can generate a super-hydrophobic surface with the Cassie state showing better corrosion resistance. Furthermore, we also attempt sputtering method to deposit a layer of polymeric membrane on those micro-sheets and successfully acquire a super-hydrophobic surface exhibiting the Cassie state with a contact angle of 170°. Compared to the single hydrothermal process, this dual process can provide a better protection for magnesium alloys in not only saline solutions but also H₂SO₄ solutions due to the trapped air pockets in the surface microstructures. In summary, these results reveal an effective and environmentally friendly means to protect magnesium alloys using the pre-corrosion products.

Keywords: Magnesium alloy, Corrosion, Surface, Coating

A high-specific-strength and corrosion-resistant magnesium alloy

Wanqiang Xu

The University of New South Wales, Australia

Abstract: Ultra-lightweight alloys with high strength, ductility and corrosion resistance are desirable for applications in the automotive, aerospace, defence, biomedical, sporting and electronic goods sectors. Ductility and corrosion resistance are generally inversely correlated with strength, making it difficult to optimize all three simultaneously. Here we design an ultra low density (1.4g/cm⁻³) Mg-Li-based alloy that is strong, ductile, and more corrosion resistant than Mg-based alloys reported so far. The alloy is Li-rich and a solute nanostructure within a body-centred cubic matrix is achieved by a series of extrusion, heat-treatment and rolling processes. Corrosion resistance from the environment is believed to occur by a uniform lithium carbonate film in which surface coverage is much greater than in traditional hexagonal close-packed Mg-based alloys, explaining the superior corrosion resistance of the alloy.

Keywords: Mg-Li alloy, Corrosion Resistant, High Specific Strength

Thermal diffusivity in binary Mg-RE alloys

Chuangye Su, Dejiang Li, Xiaoqin Zeng

Shanghai Jiao Tong University, China

Abstract: Owing to the low density, high specific strength, and good thermal property, magnesium alloys attract tremendous attention as potential heat dispersing materials. Thermal diffusivities and conductivities of Mg-Ce, Mg-Sm and Mg-Y alloys in as-cast, T4 and T6 conditions were studied at room temperature, and corresponding microstructure observation and

second phase identification were performed. All the as-cast alloys consist of α -Mg and second phases, which are Mg₁₂Ce (Mg₁₇Ce₂), Mg₄₁Sm₃ and Mg₂₄Y₅ in Mg-Ce, Mg-Sm and Mg-Y alloys, respectively. The thermal diffusivity in as-cast condition is higher than that of T4 treated counterparts, while lower than that of corresponding T6 treated alloys. For the RE elements Ce, Sm and Y, the decrement in thermal diffusivity per atomic percent addition of alloying element serving as solute atoms is almost the same. The valence and the atomic volume of the solute relative to magnesium should be responsible for the decrement value. Quantitative studies about the influence of solute atoms and second phases on thermal diffusivity indicated that the decrement in thermal diffusivity per atomic percent addition of alloying element serving as solute atoms is about 70.49 mm²/s, while that of alloying element forming second phase is 4.02~8.67 mm²/s, which means that the thermal resistivity increment caused by the alloying element serving as solute atoms is about one magnitude order larger than that of alloying element forming intermetallic compound. The results should be an important guidance for development of Mg alloys with high thermal conductivity.

Keywords: Mg-RE alloys, Thermal diffusivity, Solute atoms, Intermetallic compounds

Thermal conductivity of Mg alloys

¹Mingyi Zheng, ²Tao Ying, ¹Zitong Li, ¹Xiaoguang Qiao

¹School of Materials Science and Engineering, Harbin Institute of Technology, China, ²School of Materials Science and Engineering, Shanghai Jiao Tong University, China

Abstract: With the increasing requirement of heat sinks with light weight, Mg alloys with light weight and high strength have great potential applications in heat-sinks of electronic components. In recent years, the development of Mg alloys with high thermal conductivity and their heat conduction mechanism have drawn great attention of researchers. In this research, the effect of alloying elements and microstructure on heat conductivity of Mg alloys was studied. On the basis of the understanding of heat conduction theory of magnesium alloys, new high performance cast and wrought magnesium alloys with high thermal conductivity were developed and their applications were discussed.

Keywords: Thermal conductivity, Mg alloys

Research of squeeze casting technology of Al/Mg-based composite materials

Hua Hou, Liwen Chen, Ruopeng Lu, Yuhong Zhao

North University of China

Abstract: Squeeze casting technology has received increasing attention from both academic and industrial communities. In this study, a novel technique, secondary composite squeeze casting, was developed. The microstructure and mechanical properties of squeeze casting Al/Mg-based composite materials was investigated. The results indicate that the increase of pressure not only contributes to the refinement of grains but also results in the increasing solid solubility in the matrix and uniform distribution of eutectic phase along the grain boundary. The tensile properties increase continuously with the increase of applied pressure. The heat treatment process of Al-Si-Mg alloy prepared by secondary composite squeeze casting was analyzed based on response surface methodology. The optimum heat treatment process is found as solution treatment temperature of 540.28°C, solution treatment time of 7.55h, ageing temperature of 174.23°C, and ageing time of 8.61h.

Keywords: Secondary composite squeeze casting; Al/Mg-based composite materials; Mechanical property; Optimum heat treatment process

Elasticity Modulus and Damping in Some Novel Magnesium Alloys