MM 29: Intermetallic phases II

Time: Thursday 11:45–13:00 Location: H16

MM 29.1 Thu 11:45 H16

Site occupation and order in γ-TiAl with ternary additions — •Torben Boll[1], Talaat Alkassab[1], Zhi-Guo Liu[2], and Yong Yuan[3] — [1]) Institut fuer Materialphysik der Universitat Goettingen, Friedrich-Hund-Platz 1, 37077 Goettingen — [2]) Laboratory of Solid State Microstructures, Nanjing University, Hankou Road 22, Nanjing 210093, China — [3]Institute of Solid State Physics, Chinese Academy of Sciences, Hefei 230031, China

Titanium-aluminum-samples with additions of 3at.%Cr, 2at.% Ag and 1-10at.% Nb were prepared by means of levitation melting. The expected dual phase structure of α_2- and γ-phase could be observed with TEM.

The analysis with atom probe tomography (APT) was focused on the $L1_0$-structure of the γ-phase and performed along the superstructure ([001],[110]) and non superstructure ([100]) crystallographic directions.

A new developed algorithm was processed on the APT data to gain information on the site occupation of the ternary additions in the $L1_0$-structure. Results based on statistical evaluation of the data for the different samples will be presented. With this approach it is furthermore possible to attain information about the field evaporation field strengths for the components in the structure, which may differ from the field evaporation field strengths of the pure metals as will be discussed.

MM 29.2 Thu 12:00 H16

First PAC experiments in MAX phases — •Michael Uhrmacher[1], Hans Hofsäss[1], Jens Röder[2], Pawel Wodniecki[3], Agnieszka Kulinska[3], and Michel Barsoum[4] — [1]II. Physikliches Institut, Uni Göttingen, Germany — [2]TU Braunschweig, Braunschweig, Germany — [3]IFJPAN, 31-342 Krakow, Poland — [4]Drexel University, Philadelphia, USA

MAX phases are layered, hexagonal ternary carbides and nitrides which combine some of the best attributes of metals and ceramics: like metals, they are electrically and thermally conductive and most readily machinable. Like ceramics, they are elastically rigid, lightweight and maintain their strength to high temperatures.

PAC experiments with implanted ^{111}In have been performed to establish the PAC signal typical for substitutional probes on the In-site in the two MAX compounds Ti_2InC and Zr_2InC. This determination will be the key to investigate by PAC the microstructure of the full class of MAX phases (about 50 compounds) which do not necessarily contain In ions in the structure. Annealing, thermal stability and first experiments under compresive stress are reported.

MM 29.3 Thu 12:15 H16

Interface Reaction and its Kinetics of Al and Binary Al-alloys on Mild Steel Substrates — •Werner Fragner[1], Roman Sonnleitner[2], Peter Uggowitzer[3], and Jörg Löffler[3] — [1]ARC Leichtmetallkompetenzzentrum Ranshofen GmbH — [2]ECHEM, Kompetenzzentrum f. Angewandte Elektrochemie GmbH — [3]Metal Physics and Technology, Department of Materials, ETH Zurich

To meet the requirements of weight-saving and low-cost production of components for future transport vehicles, the concept of multi-material mix is of increasing importance. In this context aluminum-iron compounds produced by means of compound casting are considered to be of particular importance. An essential and critical aspect of such compound castings is the formation of intermetallic phases (IMP) at the Al-Fe interface. Both the nature and the kinetics of potential IMPs are not well understood and require a systematic investigation. In this presentation we document the interface formation of pure Al and binary Al-alloys on a mild steel substrate by means of isothermal wetting and dipping experiments. Tests were carried out employing the sessile droplet method in a controlled atmosphere and inserting plates into the melt. Using pure Al and Al7Si, Al7Cu, and Al7Zn alloys the interface reactions were investigated by quantitative metallography (LOM, SEM/EDX). Special attention was paid to the influence of the alloying elements on the type and sequence of IMPs at the interface and the kinetics of the interface formation with influences of environmental conditions like surface treatment and additional elements present in the melt.

MM 29.4 Thu 12:30 H16

Non-equilibrium solidification of intermetallic phases in Ni-Al and Ti-Al alloy systems — •Helena Hartmann[1,2], Peter Galenko[2], Hamid Assadi[3], Sven Reutzel[1,2], Roman Lengsdorf[1,2], and Dieter Herlach[2] — [1]Institut für Experimentalphysik IV, Ruhr-Universität, 44780 Bochum, Germany — [2]Institut für Materialphysik im Weltraum, DLR, 51170 Köln, Germany — [3]Tarbiat Modarres University, Tehran, Iran

Rapid solidification of intermetallic alloys can lead to a transition from ordered to disordered growth due to the effect of disorder trapping. It is well known that the kinetics of crystal growth of intermetallic compounds is different from that of disordered solid solutions. In the present work containerless processing by electromagnetic levitation technique is used to measure the dendrite growth velocity as a function of undercooling during the solidification of undercooled Ni-Al (β- and γ'-phase) and Ti-Al (γ-phase) alloy melts of various compositions. The structure and microstructure investigations are performed in order to identify the primary solidified phases. Special attention is payed to investigation of chemically ordered intermetallic phases at the stoichiometric compositions 50:50 and 75:25. The experimental findings are interpreted within current theoretical models for disorder trapping and dendritic growth.

MM 29.5 Thu 12:45 H16

Mechanical milling of single phase beta-Al3Mg2 — •Mira Sakaliyska[1], Sergio Scudino[1], Kumar Babu Surreddi[1], Sebastian Sperling[1], Carsten Thomas[2], Michael Feuerbacher[2], and Jürgen Eckert[1] — [1]IFW Dresden, Institut für Komplexe Materialien, Postfach 27 01 16, D-01171 Dresden, Germany — [2]Forschungzentrum Jülich GmbH, Institut für Festkörperforschung, D-52425 Jülich, Germany

In this work, the effect of mechanical milling on microstructure and thermal stability of the polycrystalline beta-Al3Mg2 phase, a complex metallic alloy (CMA) with a giant unit cell containing about 1168 atoms/u.c., has been investigated. With increasing milling time, the grain size of the beta-phase is reduced from micrometer to nanometer regime. At the same time, the mechanical treatment induces the formation of a nanoscale supersaturated Al(Mg) solid solution. Upon heating, the milled powders display a complex thermal behavior: at low temperatures, the phase evolution during heating is characterized by the rejection of an increasing amount of Mg from the solid solution with increasing temperature. At higher temperatures, a phase which resembles the starting beta-Al3Mg2 phase is formed and no traces of the solid solution can be detected, indicating that the solid solution is metastable and transforms into more stable phase(s). The subsequent exothermic events are characterized by the formation and growth of the beta-Al3Mg2 phase, thus indicating that the formation of the supersaturated solid solution during milling can be reversed by appropriately heat treating the mechanically milled powder.