MM 58: Topical Session Modern Atom Probe Tomography VI - Ordering, Clustering and Segregation

Time: Thursday 17:00–18:00 Location: H 0107

MM 58.1 Thu 17:00 H 0107

Atom Probe Tomography Analysis of Local Chemistry Fluctuations in Fe-based Alloys Affecting Bulk Deformation Behaviour — •Ross Marceau, Pyuck-Pa Choi, and Dierk Raabe — Max-Planck-Institut für Eisenforschung, Düsseldorf, Germany

The solute architecture within an alloy solid solution is increasingly recognised as a key factor in engineering the evolution of microstructure. Improved performance of advanced materials requires better understanding of how the structure and chemistry at the nanometre scale impact the overall properties, however the challenge is that characterising atomistic-level structures pushes the limits of resolution and detection of most microscopy techniques. Atom probe tomography (APT) provides a unique combination of highly resolved atomistic information, both chemically and spatially in three dimensions, which can be data-mined for quantitative nanostructural information that can be seeded directly into computer simulations to predict bulk material properties of industrially significant materials.

This project is designed in the context of high-Mn TWIP steel and a model Fe-Al intermetallic alloy, where the aim of this work is to quantitatively identify fluctuations in local chemistry using state-of-the-art analysis techniques to discern fine-scale atomic clustering/segregation phenomena. These fluctuations in local composition include short-range ordering (SRO); reputed to affect the local stacking-fault energy (SFE) of the material and thus also local and global deformation pathways.

MM 58.2 Thu 17:15 H 0107

Short range order and its correlation with anti phase boundaries in Ni2(Cr0.5,Mo0.5) alloy — Amit Verma[1,2], •Nelia Wanderka[1], Nikolai Lazarev[3], J.B. Singh[2], and M. Sundararaman[4] — [1]Helmholtz Zentrum Berlin, Berlin, Germany — [2]Mechanical Metallurgy Division, Bhabha Atomic Research Centre, Mumbai, India — [3]NSC Kharkov Institute of Physics and Technology, Kharkov, Ukraine — [4]Hyderabad Central University, India

Nickel base Ni2M (M = Cr, Mo, V, W) alloys belong to {1 1/2 0} family of alloys which undergo disorder to order transformation via a short-range order (SRO) state. In the present work, SRO to LRO transformation has been investigated in the alloy with solution treated initial microstructure. The ordering sequence has been studied using resistivity measurements and the change in resistance is correlated with microstructure. Atom probe (3D-AP) investigations revealed the presence of composition fluctuations of N2M2, N3M, N4M type (where N represents Ni atom and M represents Cr and Mo atoms). Transmission electron microscopy investigations carried out on fully ordered samples revealed the presence of anti-phase boundaries (APBs) which contained N2M2 type compositional clusters as established by TAP investigations. The appearance of the SRO state during the dissolution of the LRO could thus be attributed to the N2M2 clusters at APBs as revealed by resistivity investigation.

MM 58.3 Thu 17:30 H 0107

Atom probe tomography study of the clustering and crystallization kinetics in FeSiNbBCu alloys — •Pradeep Konda Gokuldoss[1], Pyuck Pa Choi[1], Aleksander Kostka[1], Stefanie Sandloebes[1], Dierk Raabe[1], and Giselher Herzer[2] — [1]Max planck Institut fuer Eisenforschung GmbH, Duesseldorf, Germany — [2]Vacuumschmelze GmbH & Co. KG, Hanau, Germany

Partially nanocrystalline FeSiNbBCu alloys with about 25 vol. % retained amorphous matrix are used for their excellent soft magnetic properties. Rapidly solidified Fe-Si-Nb-B-Cu amorphous ribbons upon annealing undergo nanocrystallization, where soft magnetic Fe-Si nanocrystals are formed. Nanocrystallization of Fe-Si grains in these compounds is kinetically governed by the size and density of Cu clusters that precede Fe-Si crystallization. In this work we study the kinetics of Cu clustering and subsequent Fe-Si nano-crystallization in an amorphous Fe73.5Si15.5Cu1Nb3B7 alloy, by atom probe tomography. The microstructural changes in terms of the number density of Cu clusters and the resulting size difference of Fe-Si nano crystals during isothermal and isochronal kinetic studies will be presented. Also, the direct implications of these microstructural changes on the soft magnetic properties will be discussed.

MM 58.4 Thu 17:45 H 0107

Decomposition and ordering in Ni-11.3 at.% Ti as studied by Atom Probe Tomography — •Tala'at Al-Kassab[1], Torben Boll[1], Catharina Wille[1], and Bernd Schönfeld[2] — [1]King Abdullah University of Science and Technology, Division of Physical Sciences, — [2]Laboratory of Metal Physics and Technology, Department of Materials, ETH Zurich,

Recent results obtained on the decomposition path in Ni-rich Ni-Ti are reported. For this metallic system, there are different reports with respect to the decomposition path at elevated temperatures (around 873 K). As atom probe tomographers are now collecting data in a comparatively large volume, more detailed information may now be deduced, in particular, on the early stages of decomposition. For this study single crystals of Ni-11.3 at.% Ti were grown by the Bridgman technique. Platelets were homogenized at 1443 K, quenched into brine and aged at 873 K for 5, 23, 95 and 219 h, respectively. Tips were then prepared with a <100> axis. Atom Probe Tomography analysis was performed with a position sensitive detection system, named LAWATAP at the newly established Laboratory at King Abdullah University of Science and Technology. The composition of the precipitates and the existence of aging stages will be discussed.