MM 25: Microstructure and Phase Transformations III

Time: Tuesday 11:45–13:00 Location: H 0106

MM 25.1 Tue 11:45 H 0106

Continuous freezing and delayering of argon in nanopores — •Klaus Schappert and Rolf Pelster — Universität des Saarlandes, FR 7.2 Experimentalphysik, Campus Geb. E2.6, 66123 Saarbrücken, Germany

We investigate the freezing behavior of argon in nanoporous Vycor glass. The freezing temperature of substances adsorbed in nanopores is lowered in comparison to bulk. Bulk argon freezes at 84 K, whereas argon filled in Vycor glass seems to freeze only at about 75-76 K. However, the first few adsorbed layers of argon will not freeze at that temperature and remain in a liquid-like condition. We show that both the first and the second argon layer freeze continuously over a broad temperature range of at least 40 K. These layers completely freeze only far below the bulk freezing temperature, i.e. around 20 K. Whereas those two adsorbed layers remain stable during cooling, the third one becomes unstable around 66 K, rearranges, and solid capillary condensate is formed (delayering transition) [1].

[1] Klaus Schappert and Rolf Pelster, Phys. Rev. B 83, 184110 (2011)

MM 25.2 Tue 12:00 H 0106

Needle-like solutions in three-phase equilibrium binary alloys — •guillaume boussinot[1,2], claas hueter[1], and efim brener[2] — [1]MPIE, Duesseldorf, Germany — [2]PGI, Forschungszentrum Juelich, Germany

Three-phase equilibrium is a very common feature of phase diagrams of binary alloys. The phase transformations in the neighborhood of the corresponding equilibrium temperature are very diverse whether the system is eutectic, peritectic, monotectic... We give an overview of the two dimensional needle-like steady-state solutions in these systems, which are not described by the Ivantsov theory.

MM 25.3 Tue 12:15 H 0106

Martensitic phase transition of iron — •Bertrand Dupé[1,2], Bernard Amadon[1], Christophe Denoual[1], and Yves-Patrik Pellegrini[1] — [1]CEA, DAM, DIF, F-91297 Arpajon, France — [2]Institue of Theoretical Physics and Astronomy, University of Kiel, 24098 Kiel Germany

Even if Iron is a long studied element, several of its properties remain puzzling. One of them is the mechanism of martensitic phase transition from the bcc to hcp Phases. Even in the simplest description, a shuffle and a shear are involved in this transition [1]. Several authors have described the kinetic of the transition, using Minimum Energy Path calculations with ab initio calculations[2-4] with different physical assumptions for the coupling between shuffle and shear [3,4].

In this study, we propose a new path for the transition based on ab initio calculations. We discuss the path with respects to the NEB method. Our ab initio calculations also suggest that this transition might not involve a cooperative motion of atoms in contradiction to the common rule for martensitic transitions. The key role of magnetic ordering during the transition will be also adressed suggesting a more complex Ferromagnetic to Antiferromagnetic behaviour as previously seen [3,5].

[1] Burgers, W. G. Physica, 1934, 1, 561 [2]Ekman et al Phys. Rev. B, 1998, 58, 5296 [3] Johnson, D. F. & Carter, E. A. Journ. Chem. Phys., 2008, 128, 104703 [4] Liu, J. B. & Johnson, D. D. Phys. Rev. B, 2009, 79, 134113 [5] Friák, M. & Šob, M. Phys. Rev. B, 2008, 77, 174117

MM 25.4 Tue 12:30 H 0106

Role of carbon atoms on the transformation behavior in the high manganese steels — •Jaebok Seol[1], Changyung Park[2], Pyuckpa Choi[1], and Dierk Raabe[1] — [1]Max-Planck-Insititut für Eisenforschung, Dusseldorf, Germany — [2]Dept. of Materials Science and Engineering, Pohang University of Science and Technology (POSTECH), Republic of Korea

In this study, we revealed that the γ into ϵ-martensitic transformation in Fe-17wt.% alloys was suppressed upon cooling by an increase in the carbon content by X-ray diffraction (XRD), electron back scattered diffraction (EBSD), and transmission electron microscopy (TEM). Also, the lattice parameter of austenite and the local distribution of stacking faults as a function of carbon composition have been observed through high resolution TEM. A direct observation method, based on a combined analysis of nano-secondary ion mass spectroscopy (nano-SIMS) and EBSD, was conducted to characterize the distribution of solute carbon in the alloys. Comparatively, atom probe tomography (APT) revealed that the inhomogeneous distribution of carbon played an important role on the austenite to ϵ-martensite transformation. Therefore, the segregation sites of carbon atoms in these steels were quantitatively elucidated.

MM 25.5 Tue 12:45 H 0106

***In situ* investigation of phase transitions in friction stir welded steels using high-energy X-ray diffraction** — •Malte Blankenburg, Peter Staron, Andreas Stark, Torben Fischer, Jakob Hilgert, Luciano Bergmann, Jorge F. dos Santos, Martin Müller, and Andreas Schreyer — Helmholtz-Zentrum Geesthacht, Institute of Materials Research, Max-Planck-Strasse 1, 21502 Geesthacht, Germany

When engineering metallic materials are joined by friction stir welding, thermo-mechanical processes alter the base metal microstructure and properties. This induces the formation of non-equilibrium microstructures in the joint region, which are significantly different from those found in the base material. Such non-equilibrium microstructures can reduce strength and toughness of the material and are thus important to be studied. The intermediate stages of phase transformations in steels *during* the joining process can only be registered by *in situ* experiments. Therefore, *in situ* diffraction measurements using a transportable friction stir welding system ('FlexiStir') were performed at the HZG high-energy synchrotron beamlines HEMS and HARWI II at DESY. Additionally, the phase transformations occurring in the steels used for friction stir welding were studied using a dilatometer in the synchrotron beam. As a result, time resolved volume fractions of the steel phases during the phase transitions occurring during friction stir welding in different steels were obtained.