DSL2021

17th International Conference on Diffusion in Solids and Liquids
28 June – 02 July, 2021 / MALTA

Phase Transitions at Low/Dimensional Defects: Insights from the Tracer Diffusion Measurements

Sergiy Divinski

divin@wwu.de

Institute of Materials Physics,

University of Münster, Germany

Phase equilibria and phase transitions at low-dimensional defects are in focus of an intensive research nowadays. Since these low-dimensional defects (dislocations, triple junctions, low- and high-angle grain boundaries) represent short-circuits for diffusion in metallic materials, tracer diffusion measurements represent a unique tool to discover and probe the phase transitions at defects. Recently, the existence of temperature-induced transitions in the grain boundary structure were revealed by high-precision radiotracer diffusion measurements in low sigma Cu bicrystals [1-3]. Temperature-induced phase transitions were related to an appearance of specific "kinks" in the temperature dependences of the grain boundary diffusivity and the disappearance of grain boundary diffusion anisotropy [3].

Segregation-induced grain boundary phase transitions were investigated in Cu-Bi [4] and Al-Ga systems. Measurements of Ag grain boundary diffusion in the Cu-Bi alloys highlight an intrinsic heterogeneity of the grain boundary phase transitions when the pre-melted and almost segregation-free high-angle grain boundaries co-exist in the polycrystalline Cu-Bi alloy in a broad range of volume concentration of Bi.

Metastable states of grain boundaries, which appear as a result of severe plastic deformation [5] or precipitations in multi-components alloys, are presented and thoroughly examined. Phase decomposition at interfaces in high-entropy alloys probed by tracer diffusion represents a further highlight.

[1] H. Edelhoff, S. I. Prokofjev, S.V. Divinski, Scr. Mater. 64 (2011) 374-377.

[2] S.V. Divinski, H. Edelhoff, S. Prokofjev, Phys. Rev. B 85 (2012) 144104.

[3] T. Frolov, S.V. Divinski, M. Asta, Y. Mishin, Phys Rev Lett 110 (2013) 255502.

[4] S. V. Divinski, M. Lohmann, Chr. Herzig, B. Straumal, B. Baretzky, W. Gust, PRB 71 (2005) 104104

[5] S.V. Divinski, G. Reglitz, H. Rösner, Y. Estrin, G. Wilde, Acta Mater 59 (2011) 1974.