MS41-P5 Neutron scattering investigations of microstructure in Al-Zn-Mg-Cu alloy prepared by spark plasma sintering

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Aluminum alloy samples (5.3 wt.% Zn, 2.1 wt.% Mg and 1.3 wt.% Cu) were compacted by spark plasma sintering (SPS) process from atomized powder with particle mean size of about 50 µm. The material was prepared by same SPS procedure at various temperatures (425 ^{0}C ÷ 550 ^{0}C). Scanning electron microscopy (SEM) images show quite complex structure of precipitates - as inside grains as well as at grain boundaries. The morphology of the phases remains complex after SPS sintering (Fig. 1 a). Small-angle neutron scattering (SANS) was applied for studying of this microstucture, since this method is very efficient for bulk investigations and it does not require any special samples preparation. High resolution double bent crystal SANS instrument MAUD [1] was utilized for studying of this alloys. The measured scattering curves obey power law with exponent quite close to -2 (see Fig. 1 b) in whole Q-range of MAUD. Such scattering behavior was observed for sedimental rocks with microstructure formed by surface fractal mesoporosity [2]. Other interpretation of such scattering is that clusters of intermetallic phases and pores form size distribution which correspond to scattering from fractal surface [3]. However neutron powder diffraction practically was not able to detect any intermetallic phase on strong background of α-Al.

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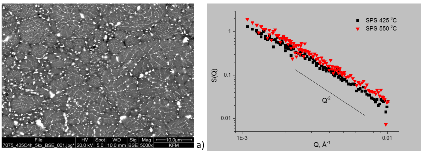

a) b)

Figure 1. Electron micrograph of compacted at 425 ^{0}C (a) and SANS from the alloys compacted by SPS at different temperatures (b).

Keywords: small-angle neutron scattering, neutron diffraction, aluminum alloys

MS41-P6 The High Energy Material Science and High Resolution Diffraction Beamlines at PETRA III

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In this contribution the potential use of high energy X-ray diffraction (50 - 200 keV) and high resolution diffraction in the hard X-ray regime (5.4 - 29.4 keV) for *in situ* and *in operando* studies of nanostructured materials will be highlighted. The physics hutch of P07 operated by DESY is equipped with a heavy load diffractometer and a surface and interface diffractometer, which can be used together with an additional tilt monochromator for scattering on liquid surfaces and interfaces. Due to the high penetration depth of high energy X-rays relatively thick samples can be investigated in transmission geometry, but also grazing incidence scattering experiments can be done making use of the large reciprocal space accessible due to the high photon energies. A set of compound refractive lenses allows focusing of the X-ray beam down to 2x30 µm² at the sample position allowing measurements of multi-layer systems, nano-rods and quantum dots. At the high resolution diffraction beamline P08 experiments on solids and liquids can be performed. For solid materials a high precision 6-circle diffractometer (Kohzu) is used, whereas liquid samples can be investigated by use of a specially designed liquid diffractometer. To achieve a high energy resolution of 10^{-5} a high resolution large offset monochromator (LOM) is installed, which is also used to separate P08 from the adjacent beamline P09 and suppress higher harmonics. Using compound refractive lenses the beamline can be operated in a collimating, focusing or microfocusing mode with beam sizes between 1500x100 µm^2 and 20x2 µm^2 Depending on the scientific problem (large q-range or high q-resolution) P07, P08 or a combination of both beamlines is most suitable. In this presentation a few highlight examples of the best use of the beamlines will be shown, e.g. *in situ* study of surface oxidation and growth of nanostructured layers.

Keywords: X-ray diffraction, beamline