Nanoobjects microscopy

Nanoscale 3d visualization of grain boundaries

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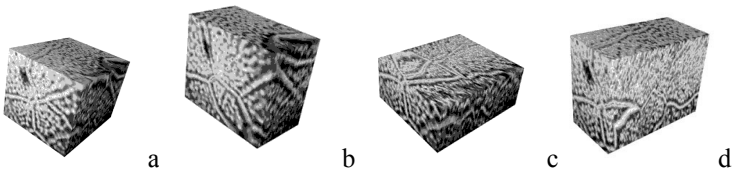
A new technique of field ion grain boundary 3d study on nanoscale level is presented. This method is characterized by a comparatively low field strength due to the presence of water vapor at the room temperature Image forming in described here a low field technique is based on phenomenon of field desorption stimulated by surface chemical reaction. The emission occurs in field strength 2.8 > $F \geq$ 0.4 V/nm with permanent field evaporation, with maximum rate along sample axis about 20 nm/s. Image is formed in two modes: 0.4÷1.6 V/nm – dynamic mode and 1.6÷2.8 V/nm – cross-shaped mode; both are named after image character. The magnification in modes is about 10^4. In dynamic mode image is formed by spots with a size ~ 50 nm[1]. Such resolution restriction allows to solve material science problems such as grain boundaries spatial grid and triple junction determination.

Constant evaporation rate in a W-20%Re alloy dynamic mode allows to obtain step-by-step grain boundaries images. Those images can be used for creating a 3d video model to observe and study grain boundaries structure in a volume (1×1×2,5 mkm^3). Fig. 1 shows a base sample (a) and 3 perpendicular cross-sections images (b, c, d).



a b c d

Fig. 1

Investigation of grain boundary structure in a grain-oriented W-20%Re alloy has shown the presence of twist boundaries segments mainly near triple junctions. Such grain boundaries were generated by the {110} planes rotated about the texture axis.

1. *Ksenofontov V. A., Sadanov E. V., Velikodnaja O. A.* Low-field ion microscopy // TechPhys.-2009.**-54**, N 4.-P. 580-585.