Texture Evolution during Deformation in Solid-Solution-Strengthened Extruded Binary Mg-Al and Mg-Zn Alloys

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The goal of this study is to examine the effects of initial texture, loading direction (tension/compression) and composition on the plastic deformation mechanisms in solid-solution-strengthened Mg-Al and Mg-Zn alloys using in-situ neutron diffraction. Two distinct initial textures were developed: (1) T1, in which {1012}<1011> twinning and basal <a>-slip are favoured in compression and (2) T2, in which {1012}<1011> twinning and basal <a>-slip are favored in tension (Figure 1). Lattice strains and diffraction peak intensity variations are measured during uniaxial tension and compression, in order to investigate the relative activities of deformation twinning and dislocation slip, and their influence on the macroscopic plastic deformation behavior. The experimental data are used to validate an elastic-viscoplastic self-consistent model of polycrystal plasticity, from which relative contributions, critical resolved shear stresses and hardening behavior of the available slip and twinning modes can be determined.

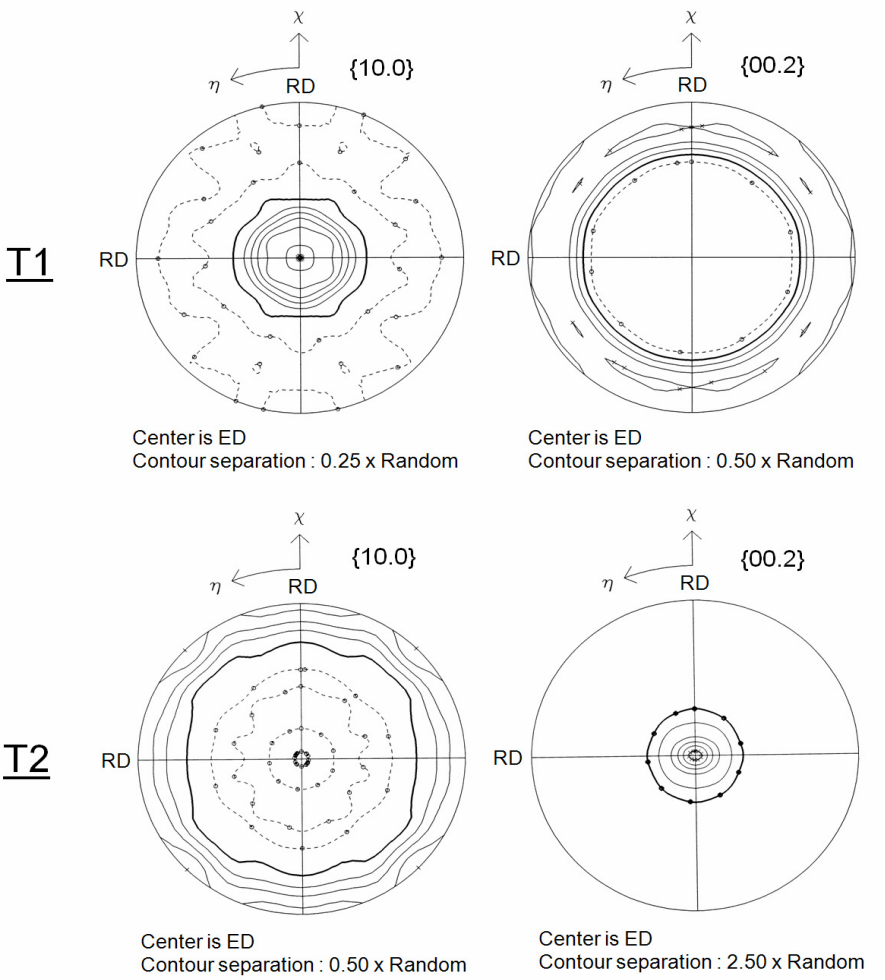

Fig. 1 Starting textures developed through thermomechanical treatment. ED and RD denote the extrusion direction and radial direction of the extruded bar, respectively. The external loads are applied parallel to ED for tension/compression tests.