Texture Evolution of Cu–Nb Composite Wires by EBSD

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Introduction

Cu–Nb wire is a high strength conductor that is used in pulsed magnets. In addition to the scale of the microstructure and mismatching between two phases in Cu–Nb systems with nanoribbons, the impact of texture on strengthening and deformation mechanisms is important. Most of the texture investigations were characterized by X-ray, transmission electron microscopy (TEM), or neutron diffraction, but not much work was undertaken on as-deformed Cu–Nb composite wires with EBSD in a systematic manner.

Experimental

The multifilament Cu–Nb wires used in this study were fabricated by accumulative drawing and bundling (ADB) process with pure Nb and pure Cu. The final wires contain different contents of Nb (vol.% = 48, 38, 27, 21, 16 for specimens with 85^0, 85^1, 85^2, 85^3,85^4, Nb filaments/ribbons, respectively).Microtexture was measured by EBSD technique (Oxford HKL Channel 5). The multi scales of Cu matrix are defined as Cu_1,Cu_2,Cu_3 and Cu_4 channels from outside Cu to inside Cu in each specimen.

Results and Discussion

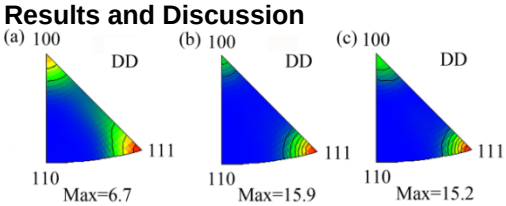

Fig. 1 Inverse pole figures (IPFs) of Cu matrix in drawing direction: (a) Cu_1, η = 5.7; (b) Cu_2, η = 10.4; (c) Cu_3, η = 15.2. η: total true strain.DD= drawing direction.

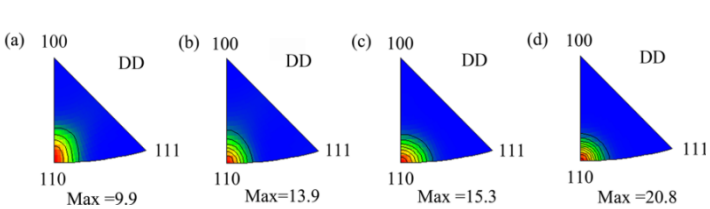

Fig. 2 Inverse pole figures (IPFs) of Nb in drawing direction: (a) 85^0, η = 5.0; (b) 85^1, η = 9.6; (c) 85^2, η = 14.4; (d) 853, η = 19.1. DD=drawing direction.

Fig. 3 shows the textures in different Cu channels. The deformation textures of Cu channels can be characterized as the major <111> and <100>, minor <112> multiple fiber textures parallel to drawing direction. These multiple textures are probably due to the balance between energy storage during deformation (dislocation storage during deformation, increased interface densities and nucleation of new grains via dynamic recovery), energy release during hot extrusion (<200> textured grains nucleate on the high angle grain boundaries and grow via grain boundary migration)[1] and rotation of <100> to <111>through <112>[2]. With increasing strains, the intensity of <111> fiber texture increases while the intensities of <100> and <112> fiber texture components decrease, indicating that <111> can be considered the stable component in Cu components of these as-drawn wires.

Fig. 2 shows the texture in Nb component. The <110> texture was observed as a major component oriented approximately parallel to drawing direction and the intensity increase as strain increases. This appears to indicate that no dynamic recrystallization occurred in Nb at these strains.

Conclusions

The texture evolution in Cu–Nb composite wires was examined by EBSD. Cu shows multiple texture components and the <111> texture is the stable one during deformation. Nb shows a stable <110> texture during deformation.

Acknowledgement

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References

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