Fatigue cracking mechanism along twin boundaries

Twin boundaries (TBs) have often been considered a good interface to connect the adjacent grains in pure Cu polycrystals, which can have good tensile strength and elongation. However, there is another question that this interface is strong or weak under cyclic loading. For answering this question, the fatigue behaviors of polycrystalline Cu and Cu-Zn, Cu-Al alloys were systematically investigated. In Cu and Cu-5at.%Al alloy, the TBs are intrinsically strong and resist fatigue cracking. However, TBs in Cu-Al or Cu-Zn alloys with different Al or Zn content are not always strong enough to resist fatigue cracking. With the decrease in stacking fault energy (SFE), some fatigue cracks were observed along or near the TBs in Cu-16at.%Al and Cu-32wt.%Zn alloys. In summary, two kinds of cracking modes adajcent to the TBs were observed, i.e. slip band and TB-cracking modes, depending on the SFE or slip mode. These new findings provide some experimental evidence for the optimum design of alloys with different SFEs to resist fatigue cracking along TBs. (see Zhang P et al., ***Philos. Mag.,* 88** (2008) 2487-2503 and Qu S et al., ***Scripta Mater.,* 59** (2008) 1131-1134)

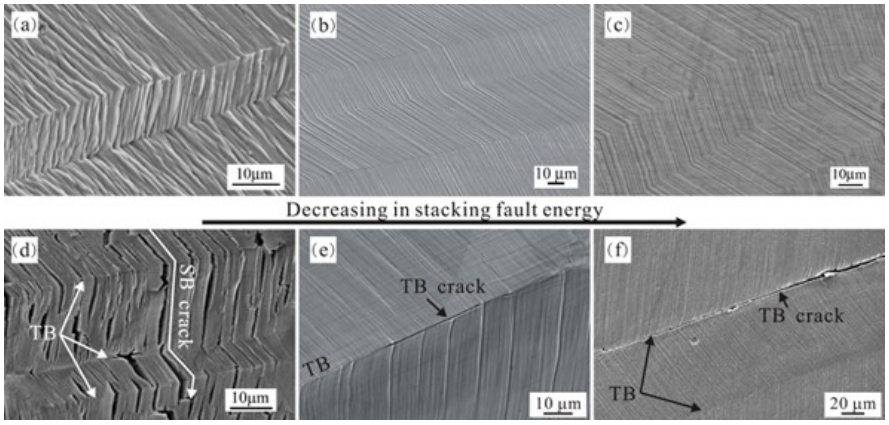

Figure: Surface slip morphologies near the TBs in fatigued materials with (a) high stacking fault energy (SFE); (b) medium SFE; (c) low SFE; and related fatigue cracking behaviors near TBs in fatigued materials with (a) high SFE; (b) medium SFE; (c) low SFE.

More news

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