

Effects of Al₃Ti particle shape on its fragmentation behavior by severe plastic deformation for Al-Al₃Ti composite

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Abstract. When Al-Al₃Ti composite containing platelet Al₃Ti particles is severely deformed, the platelet Al₃Ti particles are fragmented and its spatial distribution changes drastically. Although the fragmentation of the Al₃Ti particles by severe plastic deformation (SPD) for the Al-Al₃Ti composite would occur due to stress concentration around the Al₃Ti particle, the fragmentation mechanism of the Al₃Ti particles is still unclear. In this study, fragmentation mechanism of the Al₃Ti particles by multi-directional forging (MDF) for the Al-Al₃Ti composite is investigated. As specimens, two kinds of Al-Al₃Ti composites are prepared. One specimen is the Al-Al₃Ti composite containing platelet Al₃Ti particles, the other one is the composite containing spherical shape Al₃Ti particles. When the Al-Al₃Ti composite containing the platelet Al₃Ti particles is deformed, twin deformation occurs in the Al₃Ti particle. At this time, due to the twin deformation, step is formed at α -Al matrix/Al₃Ti particle interface. Because this step makes stress concentration in α -Al matrix, crack in the Al₃Ti particle is preferentially initiated at twin boundary and then propagates along this boundary. On the other hand, in case of the Al-Al₃Ti composite containing spherical Al₃Ti particles, fragmentation of the spherical Al₃Ti particles does not occur regardless of MDF. Therefore, it is concluded that fragmentation of the Al₃Ti particles in the Al-Al₃Ti composite by SPD is caused by stress concentration around the Al₃Ti particle.