Reviews on Advanced Materials and Technologies, 2023, vol. 5, no. 2, pp. 32–55
DOI: 10.17586/2687-0568-2023-5-2-32-55

Effects of Hardening by Annealing and Softening by Additional Plastic Deformation in Ultrafine-Grained Al and Al-Based Alloys: Brief Review

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Abstract. This is a brief review of recent experimental and theoretical results on the influence of low temperature annealing and subsequent small plastic deformation on microstructure, strength and ductility of ultrafine-grained Al and Al-based alloys structured by high pressure torsion. Some earlier results on this problem for ultrafine-grained Al and Al-based alloys structured by different methods of severe plastic deformation are also shortly presented. The reasons for the effects of hardening by annealing and softening by additional small plastic deformation of the materials are suggested and discussed in detail. Moreover, the influence of the temperature of mechanical testing and the alloying elements are in the focus of the review. It is shown that in the physical origin of these effects are the transformations of the defect structure of grain boundaries in the process of low temperature annealing and subsequent small plastic deformation of the ultrafine-grained Al and Al-based alloys structured by high pressure torsion.

Citation: Rev. Adv. Mater. Technol., 2023, vol. 5, no. 2, pp. 32–55

View online: https://doi.org/10.17586/2687-0568-2023-5-2-32-55

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