

# Abnormal Precipitation in ECAPed Al 2024

G.Tan<sup>1,2</sup>, Y. E. Kalay<sup>2</sup> and C. H. Gür<sup>2</sup>

1 Mersin University, Metallurgical and Materials Engineering, Mersin, Turkey [guherkotan@mersin.edu.tr](mailto:guherkotan@mersin.edu.tr)  
 2 Middle East Technical University, Metallurgical and Materials Engineering, Turkey, [guherkotan@mersin.edu.tr](mailto:guherkotan@mersin.edu.tr)

## ABSTRACT

Equal channel angular pressing (ECAP) is an effective method to apply severe deformation to enhance mechanical properties [1]. In the case of age hardenable alloys, it has been revealed that deformation was extremely effective on precipitation regarding several aspects such as kinetics of precipitation, size and distribution of precipitates [2-3]. On the other hand, the increased kinetics may be detrimental to the thermal stability of the alloy. The aim of the study is to investigate the annealing behavior of ECAPed Al 2024 during a 1000 hours of exposure to 150°C. A micro hardness profile, as shown in Figure 1, was generated during interrupted investigation of the samples accompanied with microstructural analysis. The precipitate size variation was measured through transmission electron microscopy images as shown in Figure 2. Precipitation was found to be effective at the initial stages accompanied with recovery. Microstructural features of recrystallization could not be detected until 168 hours of annealing as represented in Figure 3. A secondary precipitate formation was detected after 500 hours and found to be effective to stop further recrystallization. The alloy preserved its hardness following the secondary precipitate formation. The precipitation kinetics along with microstructural evolution under isothermal annealing conditions will be presented and discussed in details.

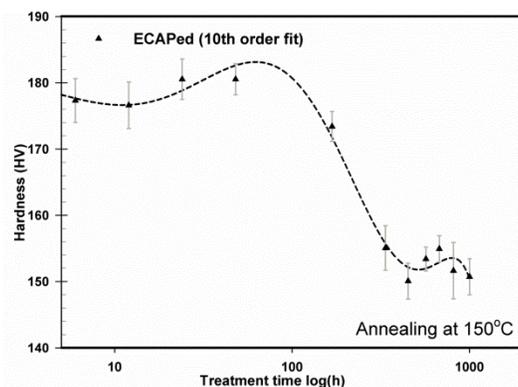


Figure 1. Annealing behavior of ECAPed Al 2024 at 150°C for 1000 hours.

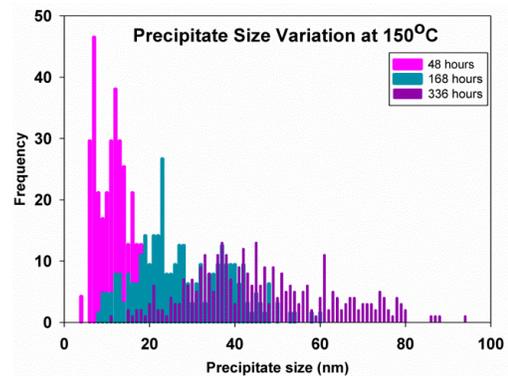


Figure 2. Precipitate size variation during annealing.

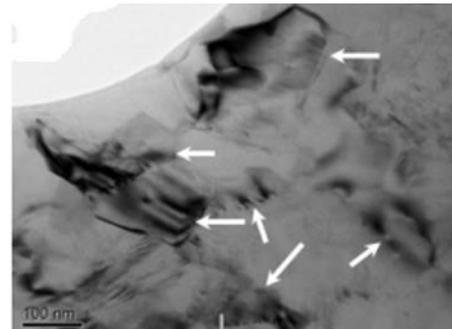


Figure 3. Recrystallized grains after 168 hours at 150°C.

Keywords: Aluminium 2024, ECAP, precipitation, recovery, recrystallization

## References

- [1] R.Z. Valiev, T.G. Langdon, Progress in Materials Science, 51, 881–981, 2006
- [2] Kotan G, Tan E, Kalay Y E, Gür C H, , Mater Sci Eng A, 559, 601-606, 2013.
- [3] W.J. Kim, J.Y. Wang, Materials Science and Engineering A, 464, 23–27, 2007

