

Komitet za termodinamiku i fazne dijagrame Srbije

u saradnji sa:

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Tehničkim fakultetom u Boru i

Associated Phase Diagram and Thermodynamics Committee
(Poland, Czech Republic, Hungary, Bulgaria, Slovenia, Serbia,
Montenegro, Romania, Croatia, Bosnia and Herzegovina)

JEDANAESTI SIMPOZIJUM O TERMODINAMICI I FAZNIM DIJAGRAMIMA

sa međunarodnim učešćem



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Jedanaesti simpozijum o termodinamici i faznim dijagramima

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The influence of solution heat treatment temperature on mechanical and structural properties of the EN AW-6060 and EN AW-6082 aluminium alloys

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Abstract

Aluminium alloys from the 6000 series are very susceptible to precipitation hardening (ageing). The process of precipitation hardening includes solution heat treatment (heating and quenching) and ageing at a defined temperature and time. The parameters that define all three of these processes have a direct impact on mechanical, physical, and structural properties. One of these parameters is the solution heat treatment temperature. The influence of solution heat treatment temperature on the microhardness and microstructure of the EN AW-6060 and EN AW-6082 aluminium alloys was studied in this paper. The investigated alloys were solution heat treated (SHT) at five different temperatures, ranging from 510 °C to 590 °C. The influence of solution heat treatment temperature on microhardness was investigated in three different stages: immediately after quenching, after quenching and partial ageing (180 °C, 1 h) and after quenching and full ageing (180 °C, 5-6 h). The samples that exhibit the lowest and highest values of microhardness after the quenching and full ageing were separated and examined by optical microscopy. Results show that the increase in solution heat treatment temperatures leads to an increase in microhardness due to better homogenization and better dissolution of the equilibrium phases.

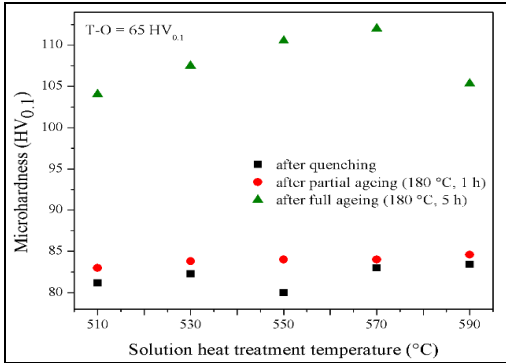
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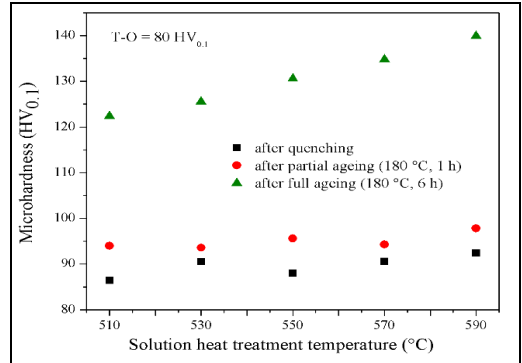
References

1. I. M. Masoud, T. Abu Mansour, J. A. Al-Jarrah, *Journal of Applied Sciences Research*, 8 (10) (2012) 5106-5113.
2. C. F. Tan, M. R. Said, *Chiang Mai Journal of Science*, 36 (3) (2009) 276-286.
3. G. Mrówka-Nowotnik, *Archives of Materials Science and Engineering*, 46 (2) (2010) 98-107.

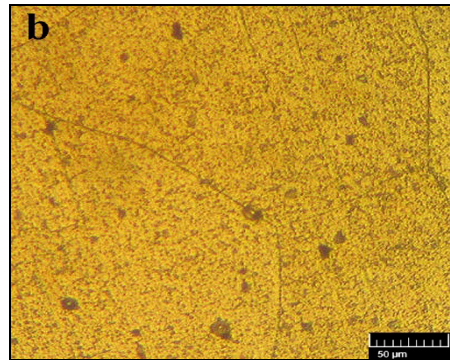
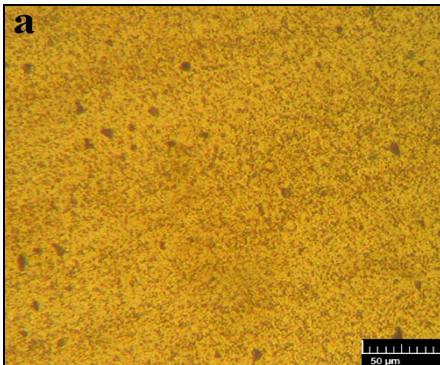
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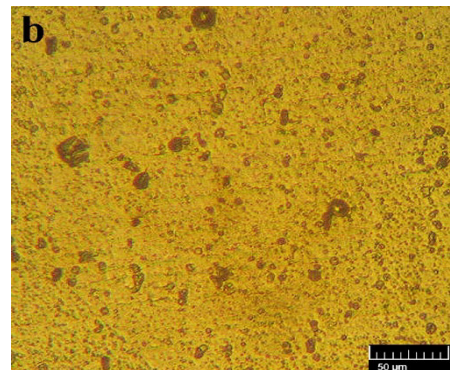
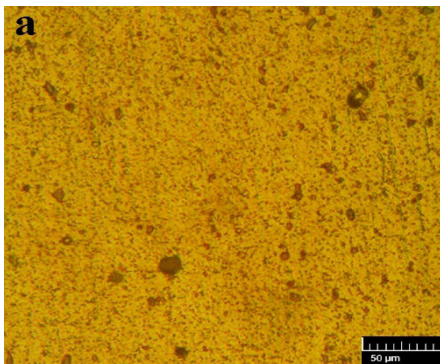
The influence of solution heat treatment temperature on the microhardness of the EN AW-6060 alloy.



The influence of solution heat treatment temperature on the microhardness of the EN AW-6080 alloy.



Microstructure of the EN AW-6060 alloy after solution heat treatment at different temperatures and full ageing: a) SHT at 510 °C and b) SHT at 570 °C.



Microstructure of the EN AW-6082 alloy after solution heat treatment at different temperatures and full ageing: a) SHT at 510 °C and b) SHT at 590 °C.