Komitet za termodinamiku i fazne dijagrame Srbije

u saradnji sa:

Fakultetom tehničkih nauka u Kosovskoj Mitrovici,
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

ZBORNIK IZVODA RADOVA

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Jedanaesti simpozijum o termodinamici i faznim dijagramima

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Jedanaesti simpozijum o termodinamici i faznim dijagramima

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Sadržaj

Plenarno predavanje:

Izvodi radova:

Influence of cold plastic deformation performed before and after aging on hardness and microstructure of EN AW-7075 aluminum alloy

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Abstract

This study investigates the influence of cold plastic deformation (CPD) performed before aging (pre-deformation) and after aging (post-deformation) on the hardness and microstructure of EN AW-7075 aluminum alloy. The alloy was annealed to a soft condition – T-O temper. Solution heat treatment was performed by solutionizing at 480°C for 1 hour in order to dissolve particles of secondary phases in a solid solution. After annealing, quenching was performed by rapid cooling in ice water. Artificial aging was done at 150°C for 30 minutes to achieve the T6 temper. CPD was performed at room temperature, with different deformation degrees (in a range of 0% - 40%), by rolling. Leeb and Vickers hardness tests were performed on all investigated samples. Also, hardness test was followed by microstructural analysis by optical microscope. The findings have revealed a significant increase in hardness with an increasing amount of deformation. The alloy in T6 temper displayed a hardness of 430 HLD. With pre-deformation, the measured hardness values were 435, 443, 459, and 477 HLD after 10%, 20%, 30%, and 40% CPD, respectively. After the post-deformation process, the hardness reached its maximum value of 507 HLD after 20% CPD. Beyond this point, cracks formed, disabling further deformation. The empirical hardness values obtained after Leeb hardness test were compared to the values converted from the Vickers hardness test. The empirical values are very similar to the converted, with a difference of less than 2%. Microstructural analysis revealed grains with well-defined grain boundaries directed in the rolling direction. The conclusions drawn from the study is that pre- and post-deformation yield higher hardness values in comparison to the only-aged sample. These findings provide valuable insights into the relationship between cold plastic deformation and mechanical and microstructural properties of EN AW-7075 aluminum alloy.

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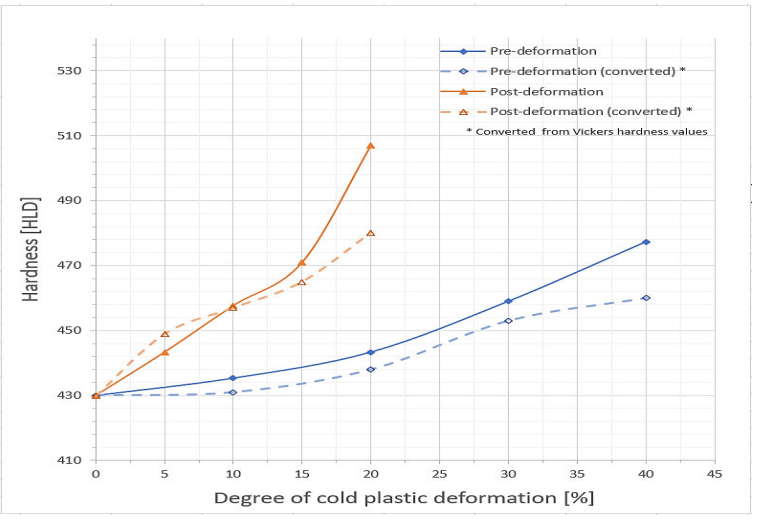
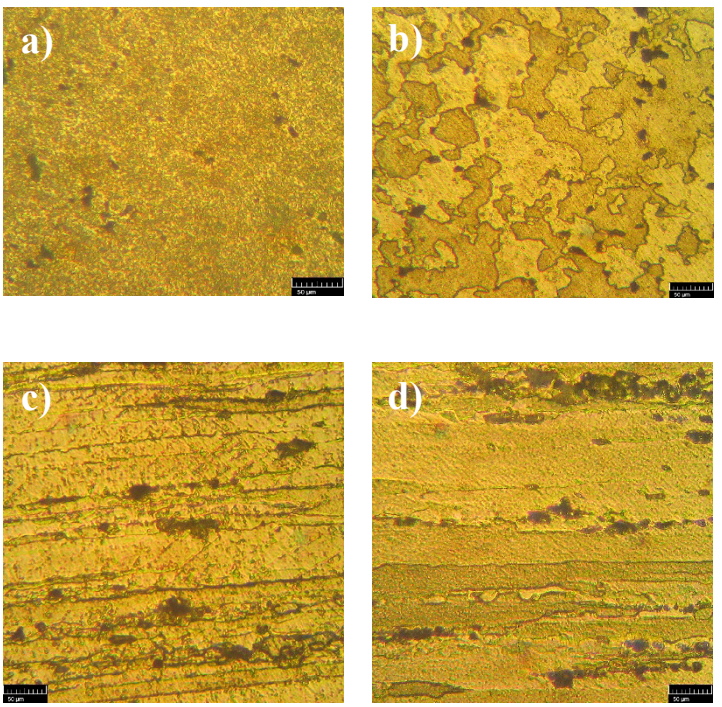
Graphical abstract:



Comparison between the converted hardness values obtained after pre- and post-deformation process of the EN AW-7075 aluminum alloy.



Microstructure of the EN AW-7075 aluminum alloy: a) in annealed state, b) after ageing without deformation, c) pre-deformation 40% and d) post-deformation 20% magnification x500.