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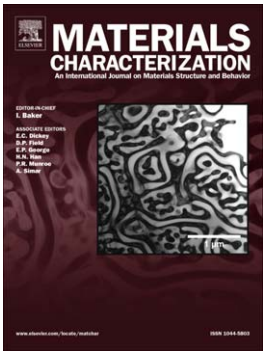


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# Fabrication of Ultra-fine grained aluminum tubes by RTES technique

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## Abstract

Recently, repetitive tube expansion and shrinking has been exploited as a means for producing ultra-fine grained and nano-crystalline microstructures for magnesium alloy and copper tubes. This method includes two different half-cycles and was based on pressing a tubular part through an angular channel die with two shear zones. Since the aluminum alloys are the most widely used materials in industries, in this study, repetitive tube expansion and shrinking as a new severe plastic deformation technique was applied to commercially pure aluminum for fabricating ultra-fine grained aluminum tubes for the first time and the ability of this process in significant grain refinement is determined even after single cycle. Transmission electron microscopy and X-Ray diffraction were used to evaluate the microstructure of the repetitive tube expansion and shrinking processed materials and the examinations showed ultra-fine grains with the average grain size of 320 nm after one cycle of repetitive tube expansion and shrinking. The yield strength, ultimate tensile strength increased notably by the factor of 2.17 and 1.27 respectively, after one cycle of repetitive tube expansion and shrinking, whereas the elongation to failure as well as the uniform elongation decreased. Furthermore, micro-hardness distribution through the part's section proposed the hardness increasing to ~55 HV from the initial value of ~28 HV after one cycle of repetitive tube expansion and shrinking.

***Keywords:*** *repetitive tube expansion and shrinking; severe plastic deformation; ultrafine grain; mechanical properties; pure aluminium.*

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