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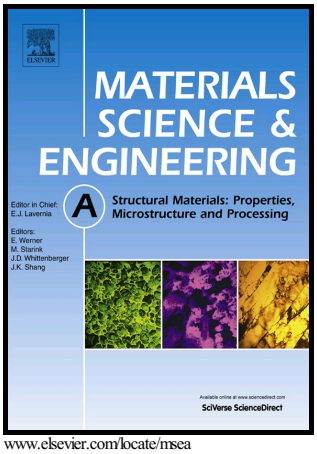

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Simultaneous improvements of the strength and ductility of fine-grained AA6063 alloy with increasing number of ECAP passes

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Abstract

In this research, grain refinement through severe plastic deformation (SPD) in combination with a thermal treatment to create a fine initial grain structure with a high degree of supersaturation was taken as a viable approach to achieving simultaneous increases in the hardness, strength and ductility of the aluminum alloy AA6063 during further SPD. A recrystallized structure with grain sizes around 20 μm was obtained after two passes of equal channel angular pressing (ECAP), followed by a thermal treatment at 500 °C for 10 s and water quenching. The alloy with the supersaturated α-Al matrix was subjected to further ECAP processing up to six passes to create a cellular structure on a nano scale. Hardness and tensile tests revealed the changes of hardness, strength and ductility along with increasing number of ECAP passes. It was found that after two ECAP passes, the ductility of the alloy decreased from the value after the prior two-pass ECAP and thermal treatment. However, by further ECAP processing up to six passes, the ductility increased along with the increases in hardness and strength. The remarkable improvement in ductility

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