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Effect of a sequence of layers on microstructure and mechanical properties of ultra-fine grained AA2024/AA5038 laminated composites produced by accumulative roll bonding (ARB)

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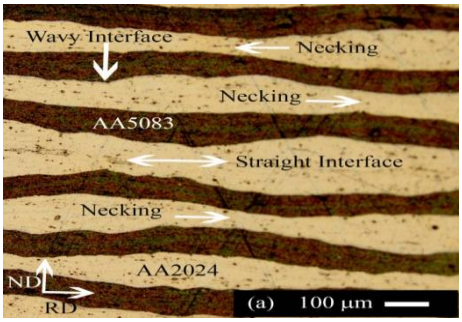
Abstract

In this study, the ultra-fine grained AA2024/AA5038 laminated composites were created at four accumulative roll bonding (ARB) cycles. An optical microscope (OP), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and Electron back-scattering diffraction (EBSD) were used to evaluate the microstructure. The TEM analysis showed that four ARB cycles cause grains with dimensions less than 500 nm. The micro-hardness and the tensile tests were used to check the mechanical properties of the composites. The AA2024 layers were necked within the AA5083 layers due to the two alloys' difference in fluidity and hardness. Therefore, up to the third cycle, the slope of the tensile strength increase of the AA5083/AA2024 composites created by the ARB method was reduced. No necking was observed in the two inner layers with the AA2024 composition at four cycles. After the fourth cycle, more than 80% increase in the tensile strength of the composites compared to the annealed sheets was observed. This is due to the UFG structure, work hardening, and change in layer sequence in the fourth ARB cycle.



Keywords: Accumulative Roll Bonding (ARB); AA2024/AA5038 laminated composites; Ultra-fine grained (UFG); Tensile Strength; Electron Backscatter Diffraction (EBSD).

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