A Study of A6061-T6 Optimization Process via Taguchi-PCA Method

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ABSTRACT

Aluminum alloy is widely used in energy conservation and environmental protection, because of its high specific strength, corrosion-resistance, and recovery easiness. Heat-treated aluminum alloy requires heat treatment technologies that achieve quality stability. However, heat treatment processes are subject to the impact of multiple factors such as solution treatment, quenching, and artificial aging that result in quality instability. This study applied the Taguchi method for parameter optimization design of the A6061-T6 heat treatment process. First, the preliminary Taguchi experiments were conducted for parameter optimization design for single performance characteristic. Principal Component Analysis method was then applied to convert the values of multiple performance characteristics into a single performance index, which was the optimal integrated solution. The comparison of confirmation experiments and the optimization values of single performance characteristic, the mechanical properties including hardness, tensile strength, and elongation were tested. The testing results demonstrated that tensile strength along the rolling (T direction) was improved by 0.2%, and the elongation rate decreased by 1.1%. The indicator variance analysis of multiple performance characteristics index and factor analysis results suggested that artificial aging temperatures primarily affected the manufacturing process. The validation results were satisfactory and cost-effective to lower the experimental costs.

Keywords : Multiple Performance Characteristics、Analysis of Variance、Principal Components Analysis、Taguchi Method、T6、A6061

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