

# Aluminum Upgrade Recycling Process

Succeeded in producing high-performance aluminum under optimal processing conditions

#Metal #Material Science #Material Informatics #Manufacturing #Process Informatics  
#Deep learning with minimal data #Multi-objective optimization #Explainable AI

## Abstract

In aluminum recycling, research applying Multi-Sigma™ has enabled the optimization of manufacturing conditions using only 18 experimental data points to target 6 key output variables.

## Introduction

Aluminum recycling is essential for sustainability but often results in increased impurities, reducing functionality compared to virgin aluminum. AIZOTH Inc. tackles this by developing an upgrade recycling technology, evaluating the process cost and environmental impacts, and optimizing conditions with AI to maintain high functionality.

## Challenge

Increased impurities in recycled aluminum decrease its functionality. The goal is to produce recycled aluminum with high functionality, comparable to pure aluminum.

## Solution

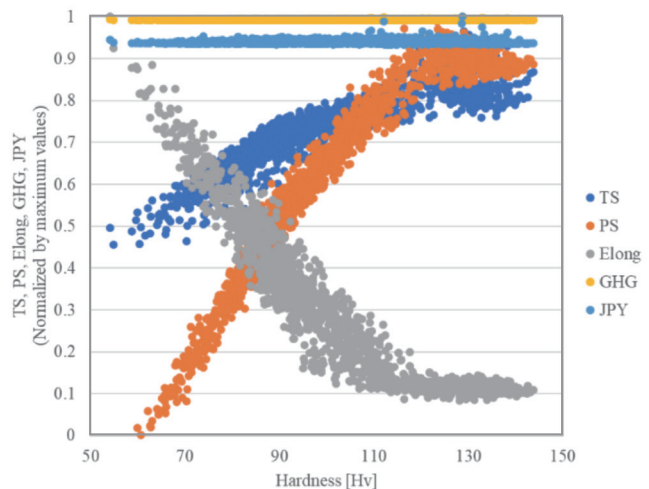
Developing aluminum materials via trial-and-error experimentation is costly and time-consuming. This study used 18 experimental data points to create an AI model. The model optimized six input variables (e.g., impurity concentration, solution treatment) and six output variables (e.g., experimental results, GHG emissions, costs).

## Results

**Optimization:** Achieved ductility over 15% and strength comparable to high-tensile steel.

**Prediction Accuracy:** Predictions within 10% error for five variables and 20% for one variable.

**Factor Analysis:** Clarified relationships between explanatory and objective variables.



AIZOTH provides AI services such as Multi-Sigma, AI consulting, spot support to optimize manufacturing conditions, and commissioned R&D.

Multi-Sigma is the cloud-based AI software for R&D to reduce the effort of experiment drastically and also to help researchers finding the innovative solutions for their actual problems with minimum experimental dataset. For more information, visit <https://aizoth.com/en/>.

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