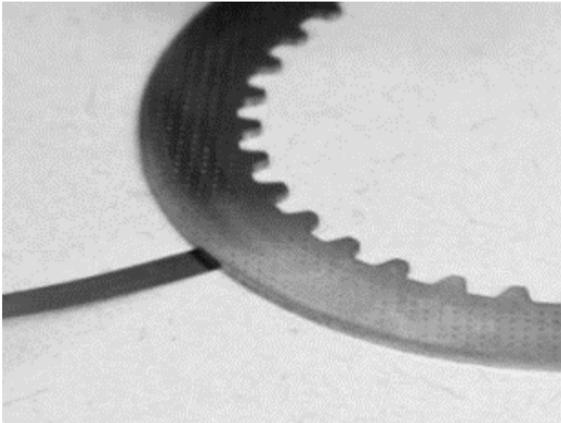


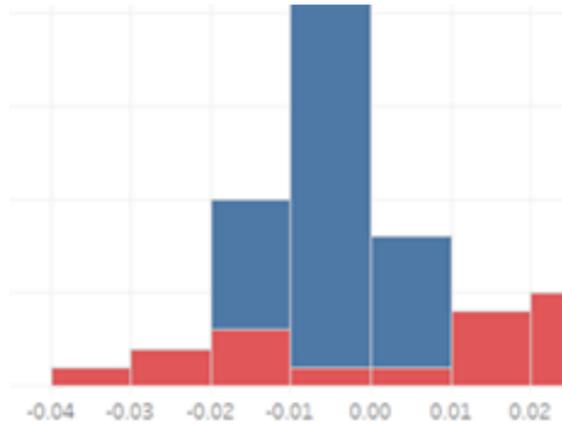
# Residual Stress and Warpage

Learn how our Material Support & Solutions team solved this customer material issue.



## THE PROBLEM

Residual stress in flat rolled steel can lead to part warpage that results in performance issues. An increasing issue is part warpage at service conditions. Work was performed to understand residual stresses in flat rolled steels, to identify what was unique about Worthington's processing that prevented warpage from occurring.



## THE ANALYSIS

Significant time was spent evaluating numerous research level techniques for quantifying residual stress in materials, but no techniques were identified suitable for production requirements. Alternatively, an extensive experiment was conducted to study the impact of different processing conditions on the tendency for a cold rolled strip product to warp at elevated temperature.



## THE SOLUTION

The intent was to evaluate a robust range of processing conditions that are used for plain carbon cold rolled strip production. The impact of cold rolling mills, cold reduction percentages, annealing steps were explored in this project.

## — THE ACTION

A wide variety of processing parameters for cold rolled strip products were tested for tendency to warp, all products exhibited minimal warpage at service conditions. Contact the Material Support & Solutions team at Worthington.