High Strain Rate Measurements of Inconel 625 for Dynamic Forming Simulations

This project focuses on the mechanical behavior of Inconel 625 at various temperatures and strain rates to better understand how the material behaves during dynamic metal forming processes. Inconel 625 is a desirable material in many areas of industry for its high temperature strength and its capabilities in sheet metal forming, but interesting phenomena occur at high temperatures (>700 C) that decrease its strength which is an intriguing area to examine. We use a specialized Pulse-Heated Split Hopkinson Kolsky Bar to observe stress and strain at high strain rates () and temperatures up to 1000 °C, and a servo-hydraulic test frame to measure the low strain rate response (). Specifically, we are interested in the yield, hardening and fracture behavior at different strain rates and temperatures. These measurements are then used to calibrate the Johnson-Cook flow stress model which is a simple but powerful equation for material strength at high strain rates and temperatures. The calibrated model will then be used to simulate the dynamic forming of laminae components for a heat exchanger to allow electricity to be created from waste heat at various energy consumption sources.