Modelling 3D Printing Bonds Using a Thermoplastic Welder

Overview
The bonds between the plastic used in 3D printing are critical and needs to be carefully studied. A flat plate welding machine will be produced that can validate a new theory that takes the additional rate reduction of entanglements into account using welded tensile specimens.

Objective
Welds ABS, Ultem, and Polycarbonate plastics; 6 specimens at once, Quenching device for alternate temperature histories, closed loop temperature control, uniform temperature history, under a budget of $1000.

Approach
- Identified customer needs through interview with sponsor, no on-site visits required
- Evaluated needs through AHP matrix
- Identified 6 relevant patents and 4 current products sold on the market
- Completed a brainstorming proves focusing on the hot plates ability to meet all the various faces of tensile specimens.
- Pugh scoring matrix utilizing AHP weighted customer needs identified the chosen concept
- Concept design created into a 3D CAD model
- 3D CAD model identified minor problems in concept; alignment of samples, u-shaped slider manufacturability, quench container being contained in a tub, cost of bearings
- CAD model assessed in Solid Works in thermal and stress analysis
- Fabricated a prototype
- Validated movement of push arms and hot plate assembly
- Validated functionality of hot plate assembly

Outcomes

The thermoplastic welder will create tensile specimens for a new theory regarding bond strength.
- The sponsor will save a minimum of $500
- Unique and original tensile half specimen creator built and designed
- Further improvements through use of v-rails for construction of base to be cheaper and more ergonomic, add counterweight to balance samples as pushing, and spring to hot plate to make movement of assembly simpler