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Introduction

- Single Point Incremental Forming (SPIF) is a cold forming technique used for forming sheet materials without the use of dies.
- Forming is localized, incremental and dependent on the toolpath.

OBJECTIVE

- Develop an approach for improving polymer SPIF process.
- Use external heat to aid in formability of polymer sheet and reduce forming forces.

EXPERIMENT

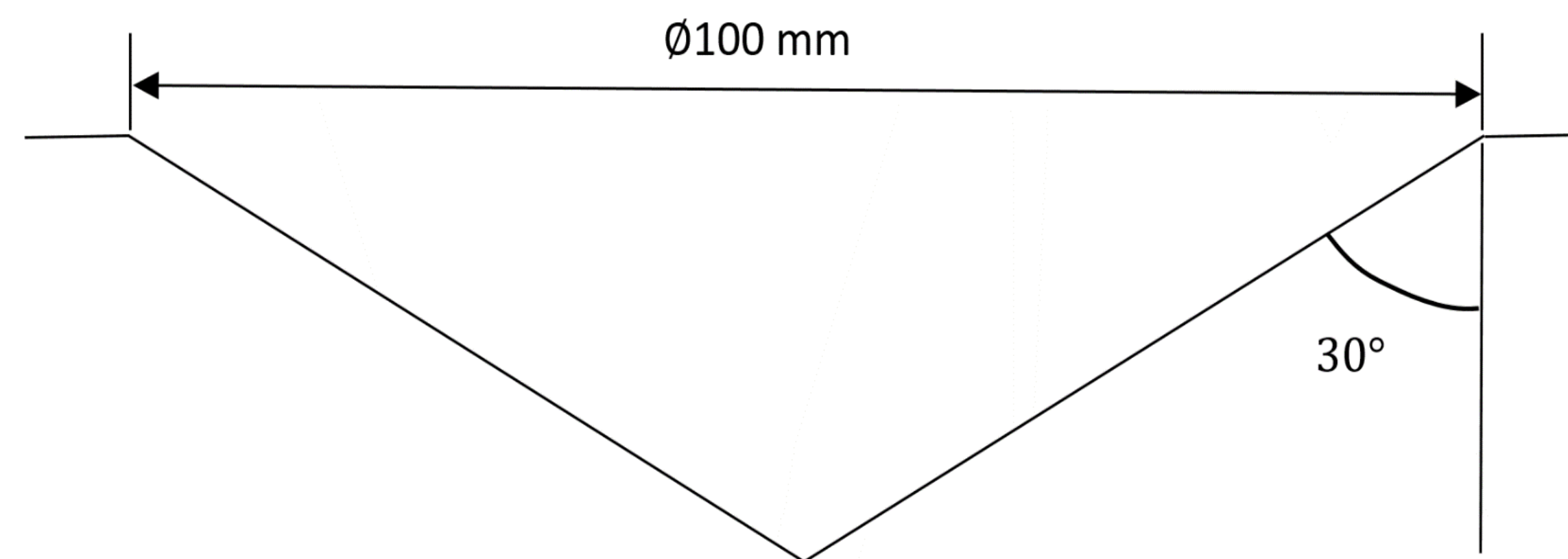


Fig 1. Toolpath for test geometry (cone)

PARAMETER	VALUE
Tool diameter [in]	1/8 inch
Step size [mm]	0.25
Feed rate [mm/min]	500
Air volume [cfm]	11.6
Temperature settings [°F]	0,150,200,250,300,350
Repetitions	3
Material	Polystyrene
Sheet dimensions[in]	12 x 12 x 1/32

Table 1. Design of Experiments

EXPERIMENTAL SETUP

- The platform is a Shapeoko CNC machine.
- Available area for forming is a circle of diameter 10" .
- A Steinel heat gun is mounted on the machine.
- Designed a nozzle to hold the tool and also channel hot air around it.

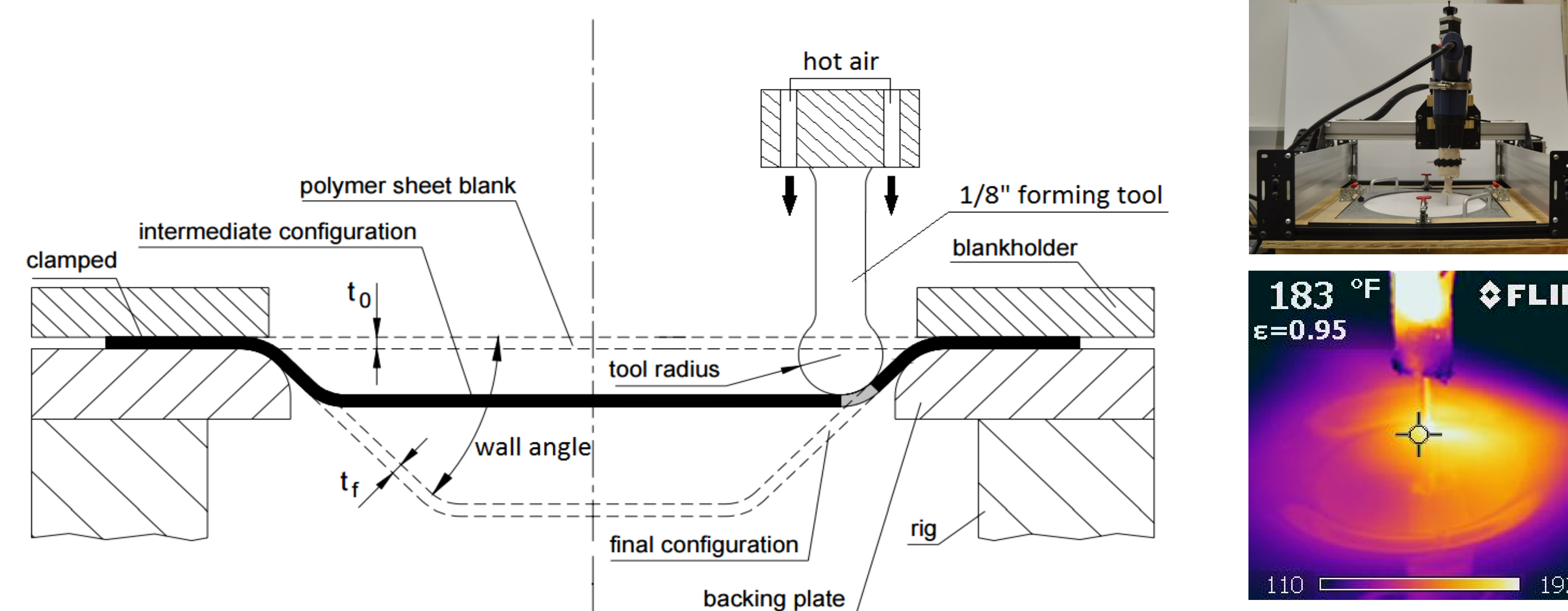


Fig 2. Experimental Setup

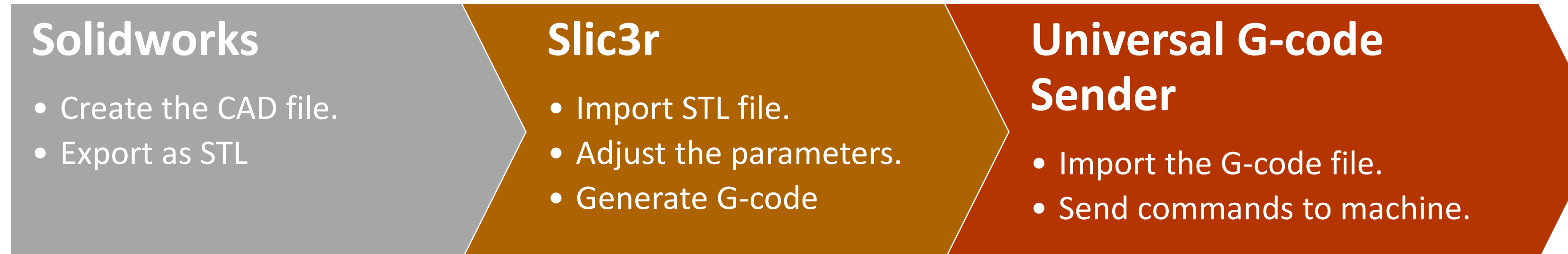


Fig 3. Software used for the process

SHAPES CREATED



Fig 5. Different shapes created using the setup

CONCLUSIONS

- Higher depths were achieved using heat thus showing a reduction in the forming forces.
- The temperature range was established to be 250-300°F for successful forming.
- Lower temperatures result in higher forming forces.
- Higher temperature results in thermal failure.
- The profiles obtained are to be compared with CAD models to determine the best data point(s).

RESULTS

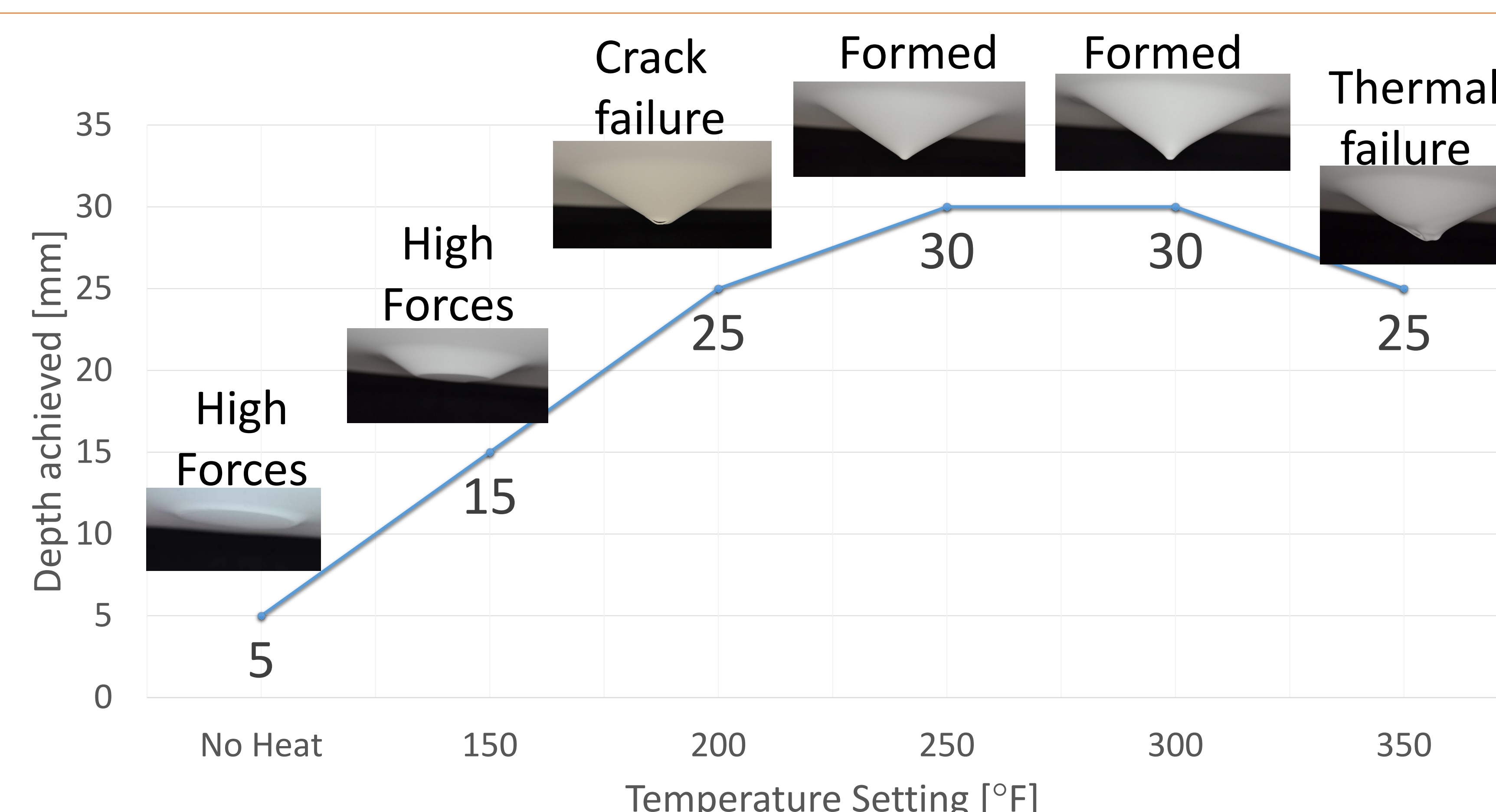


Fig 4. Depths obtained for different temperatures

APPLICATIONS

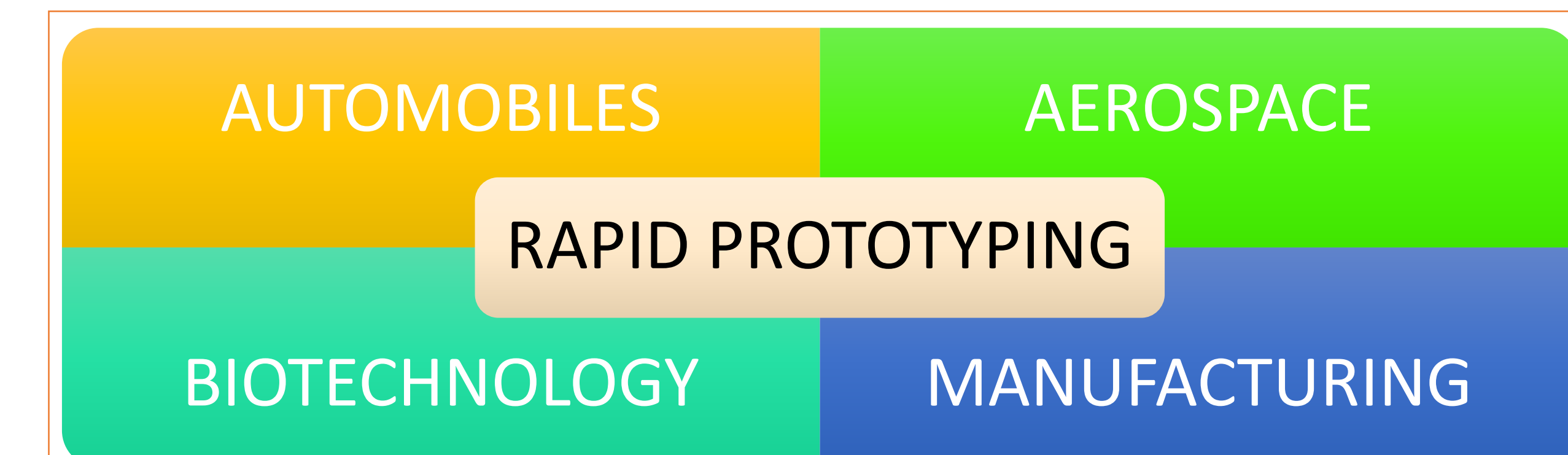


Fig 6. Applications of Single Point Incremental Forming

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