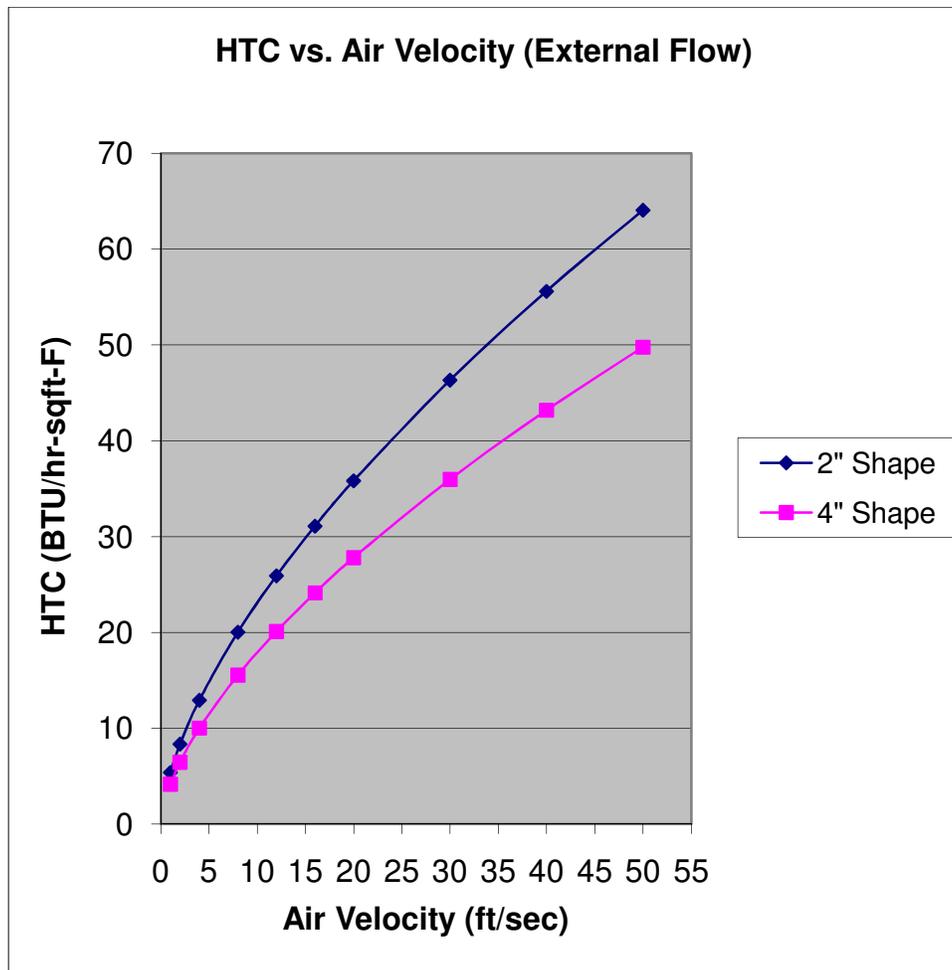


UNIT 51: Modeling Heat Treat Processes

SOLIDCast can be used to model the heating of a casting in a heat treat oven or furnace. This can be done as follows:

1. Create Mold Material (using “Normal Mold” type) that has the same properties as that of the cast alloy.
2. Create or import the casting model, and designate it to be made of this Mold Material.
3. Set the ambient temperature to the oven or furnace temperature (see below for variable ambient temperatures)
4. Set an appropriate HTC as the external HTC, based on air velocity (see chart below)
5. It’s usually a good idea to place thermocouples in areas of interest in the casting.
6. Mesh the model with no mold.
7. Run a simulation, specifying a time to stop in minutes.

Some typical Surface Heat Transfer Coefficients vs. Air Velocity are given below:



Time-Variable Furnace Temperature:

It is possible to vary the ambient temperature around a model for the purpose of simulating various heating cycles in heat treatment. This is done using the Set Up Variable Furnace Temp utility, described in Unit 46.

That utility creates a text file that consists of a series of lines. On each line is given the time in minutes, followed by a temperature. For example, for some portion of a typical cycle, the contents of the file might be as follows (these values are in °C... they can also be specified in °F if your system is set to English units):

```
0. 26.  
120. 200.  
360. 200.  
420. 400.  
780. 400.
```

The above would tell the system the following:

```
Start at time 0 at temperature 26 C.  
In two hours, ramp temperature up from 26 C to 200 C.  
Hold at 200 C for 4 hours.  
In one hour ramp up from 200 C to 400 C.  
Hold at 400 C for 6 hours
```

and so forth. This is only an example, but it shows the idea.

A few additional notes about Heat Treat Simulation:

We have found that if you try to interrupt a simulation that contains no actual casting material, an error occurs. We have not yet tracked this error down. What does seem to work is to run this and specify a time at which the simulation stops, then just allow the simulation to stop at this point. You can then examine the temperature. If you want to continue the simulation after this, you can reset the simulation stop point using the Reset Simulation Stop Point utility.

If a small shape of casting material is placed in the model somewhere outside the shape being heat treated, then this satisfies the need of the system to have some casting material and allow a normal type of interruption and restarting. Just a small sphere of casting material, suspended in space outside the heat treat shape, would be sufficient. This will not affect the temperature in the heat treat shape. You would then go ahead and mesh with no mold material.

Currently, the only type of plotting that can be done to show the heat treated part (which is considered mold material) is the Cut Plane plot.

Also... Note that when you are finished with the simulation, you should run the Set Up Variable Furnace Temp utility once more and click on the DEACTIVATE Temperature Profile button, so that it will not affect other simulations.