UNIT-4- POWDER BASED ADDITIVE MANUFACTURING SYSTEMS

Case studies on LOM Laser

A previously developed and verified thermal model for Laminated Object Manufacturing (LOM) was used to investigate the effects of various processing parameters on the temperature profile in a LOM part during the build cycle. The mathematical model, based on 3-dimensional transient heat conduction in a rectangular geometry LOM part, allows calculation of the transient temperature distribution within the part during the application of a new layer as well as during other periods of the LOM build cycle. The parameters roller temperature, roller speed, chamber air temperature, base plate temperature, and laser cutting time were independently varied, and the LOM process response simulated. The results were analyzed in order to gain insight into potential strategies for intelligent process control.

Material	Silicon carbide ceramic tapes
Thermal Conductivity	1.25 $Wm^{-1}K^{-1}$
Density	1.98 g cm^{-3}
Heat Capacity	1.05 $Jg^{-1}K^{-1}$
Part dimensions	121.9 mm x 53.3 mm
Layer thickness	0.25 mm
Number of layers	20
Heat transfer coefficient (part to air)	18 $Wm^{-2}K^{-1}$
Heat transfer coefficient (part to base)	14 $Wm^{-2}K^{-1}$
Air temperature	22°C
Base plate temperature	22°C
Initial temperature of material	22°C
Roller velocity	25.4 mm sec^{-1}
Roller contact strip width	9 mm
Roller temperature	91°C
Heat transfer coefficient (roller to part)	3300 $Wm^{-2}K^{-1}$
Build cycle time	120 seconds

The next test involved variation of the base plate temperature only. At this point in the study, it was decided to deviate from the base case parameters by using a roller temperature of 2000 e for many of the remaining trials. The reason for doing this was to amplify the effects of changes in the other parameters such as base plate temperature, chamber air temperature, etc. A laser cutting. Time of 77 seconds was used in the .base simulation. Changing the laser cutting time between the applications of successive layers of build material should affect the part temperature due to the fact that increasing. This delay time allows additional time for the part to cool by heat loss to the surroundings and base plate. The reason for investigating this effect is because the cycle··time usually varies throughout the process.