

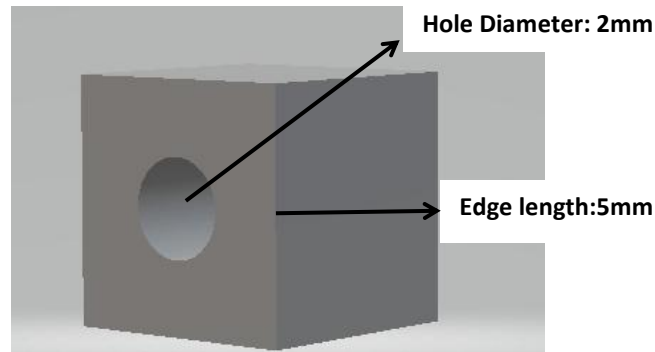
Assignment-5

Residual Stress and Distortion Prediction in LPBF Samples

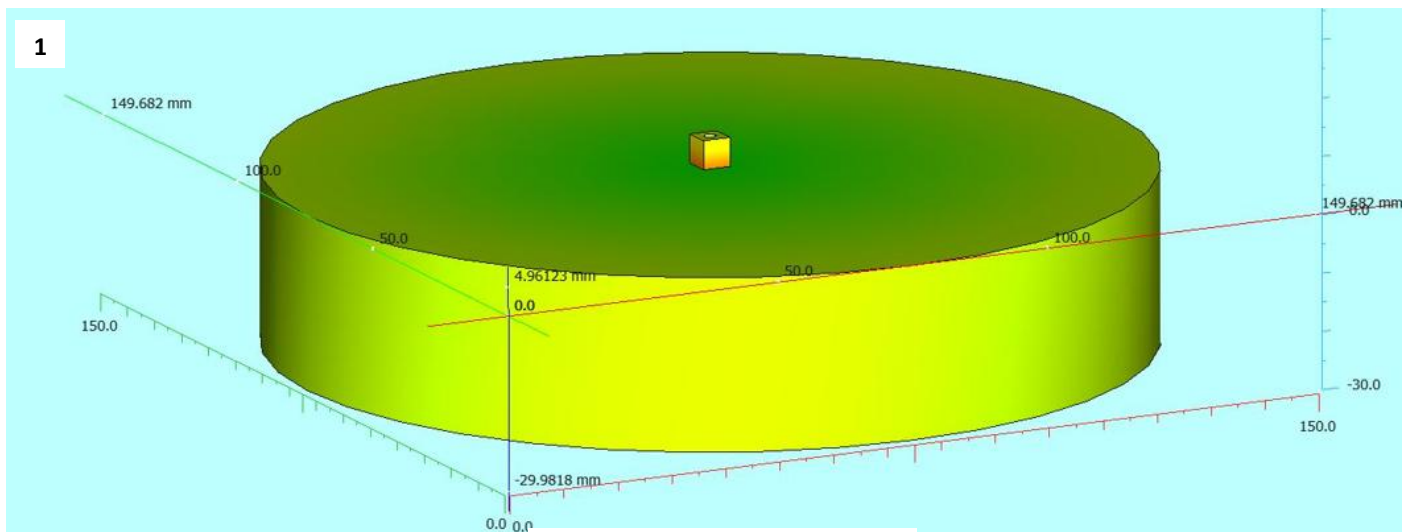
• Process Parameters

	Material	Build Plate Material	Laser Power(W)	Scan Speed(mm/s)	Scan Strategy	Layer Thickness(mm)
Case1	316L	316L	100	500	Bidirectional	0.04
Case2	316L	316L	200	500	Bidirectional	0.04
Case3	316L	316L	300	500	Bidirectional	0.04

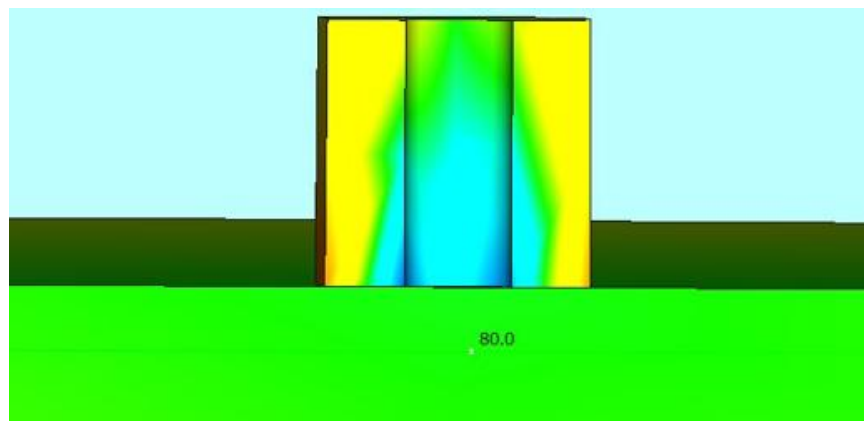
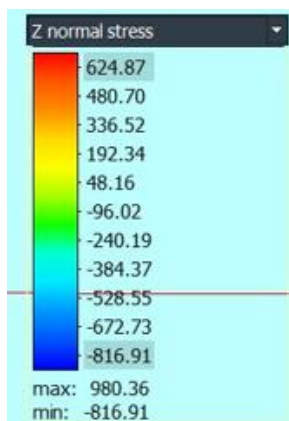
• Sample:



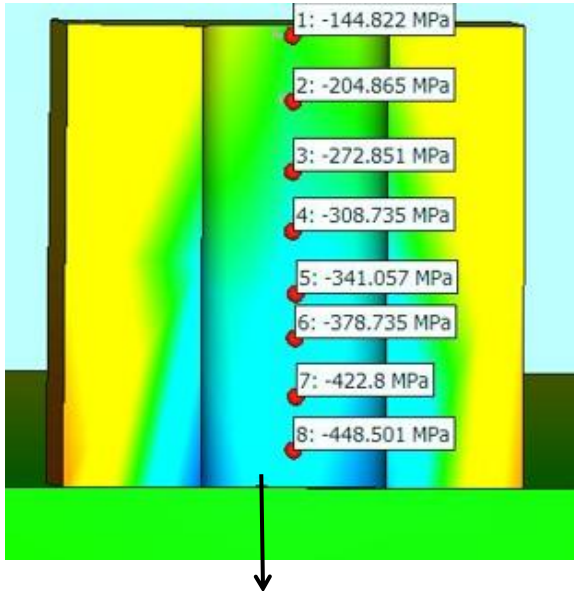
• Case 1: Laser Power-100W



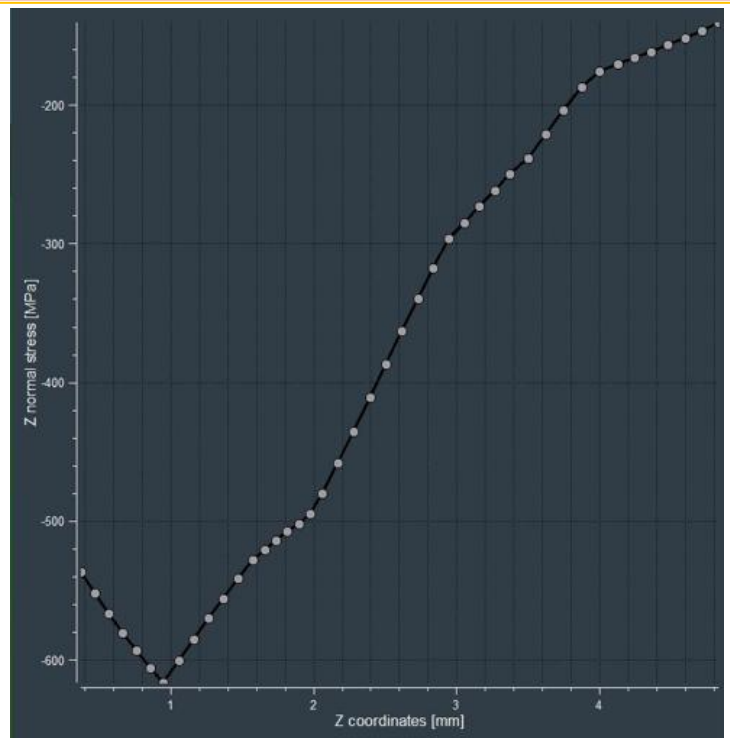
Component on build plate



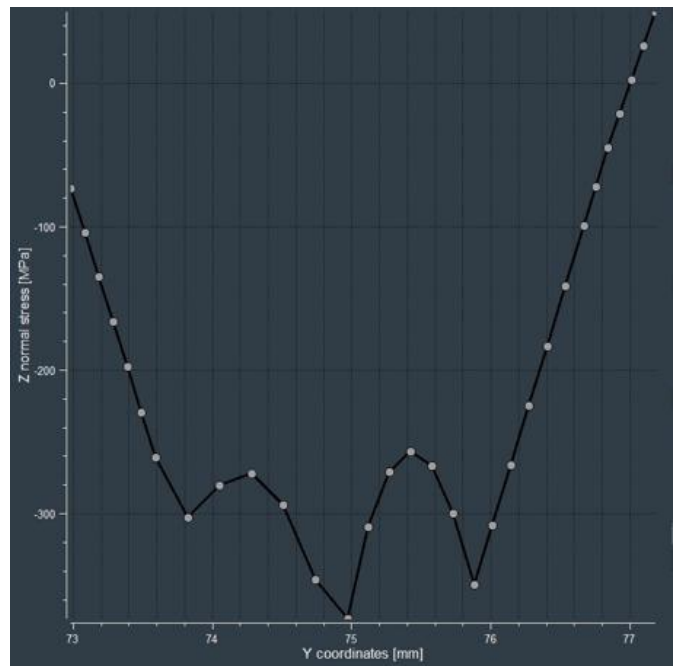
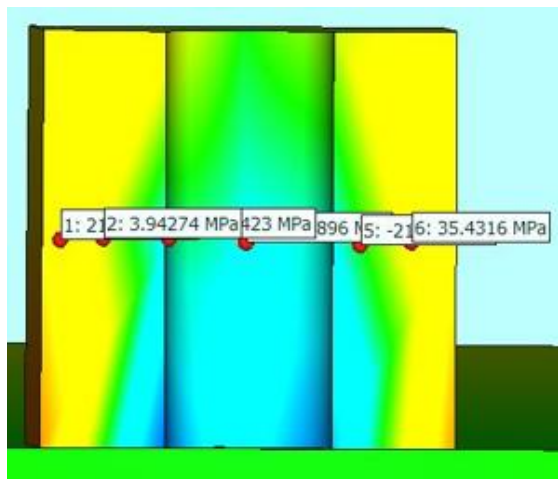
Cross section of the Component parallel to z axis



Outer surface of the Component under tensile residual stresses, because component not released from the built plate

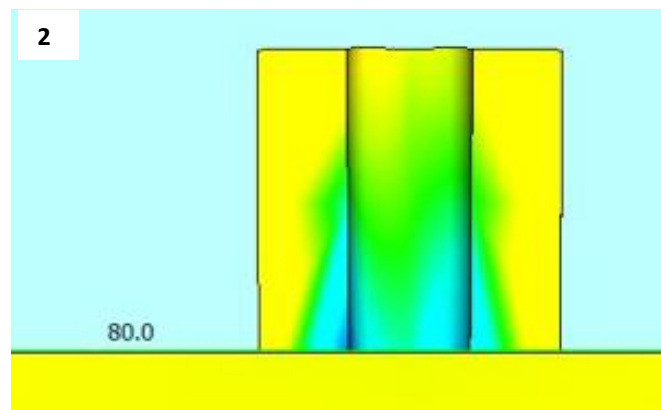
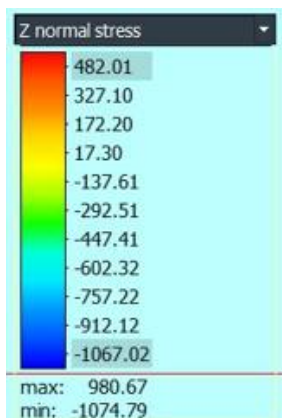


Z normal stress(MPa) vs distance(mm)



Z normal stresses in Y direction

- Case 2:Laser Power-200W



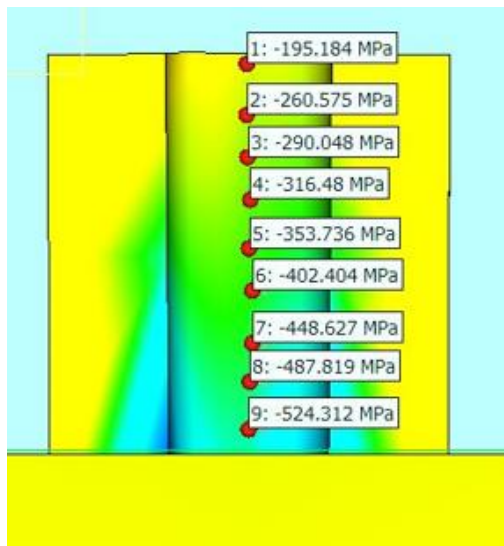


Fig.Z normal stresses in Z direction

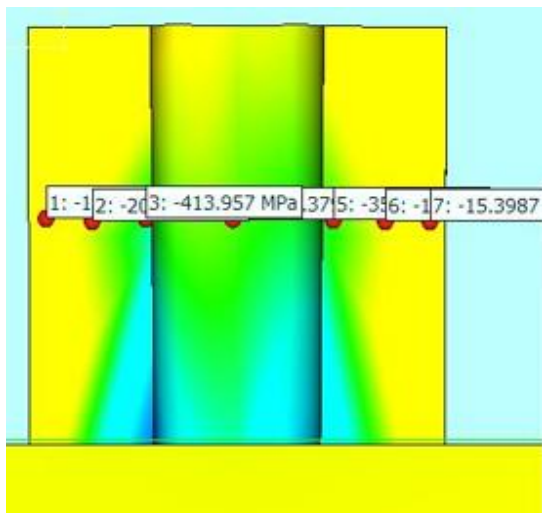
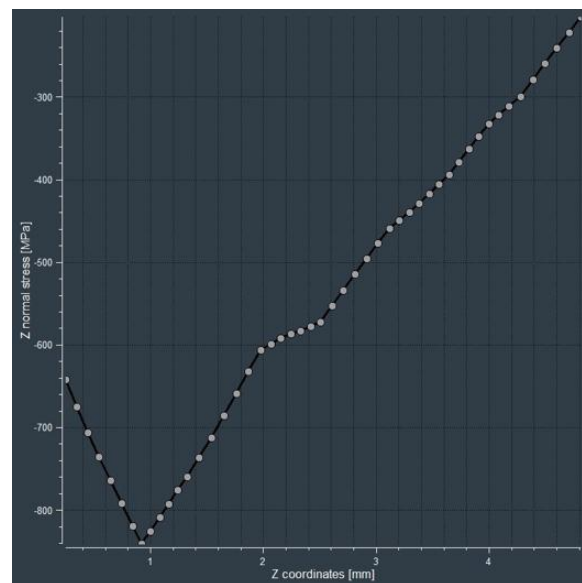
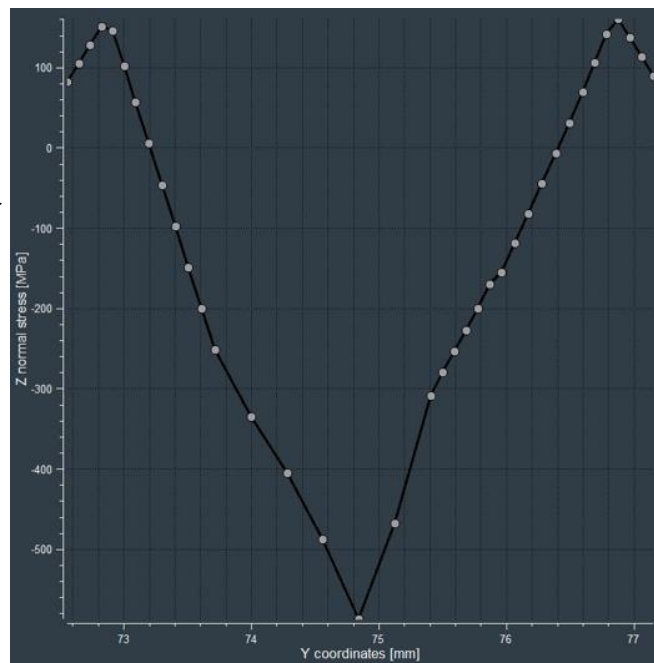
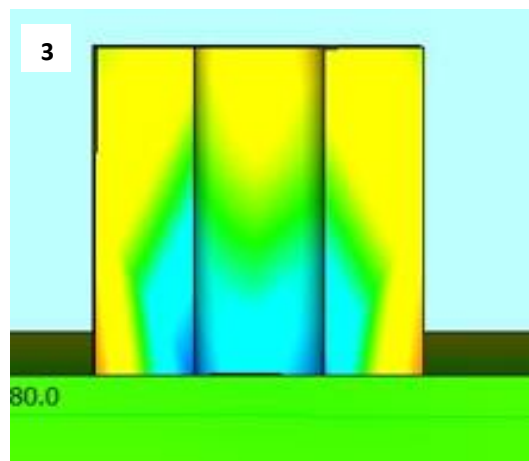
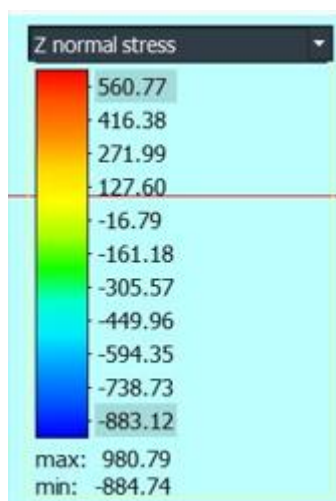


Fig.Z normal stresses in Y direction



• Case 3:Laser Power-300W



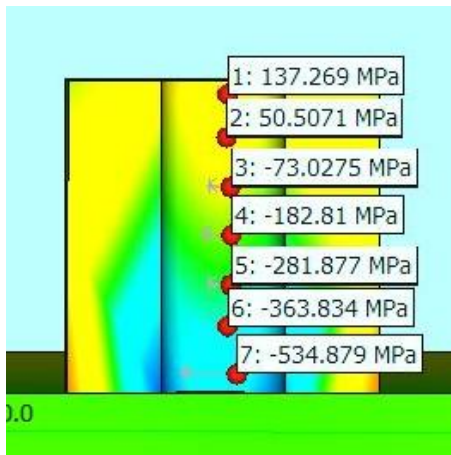


Fig.Z normal stresses in Z direction

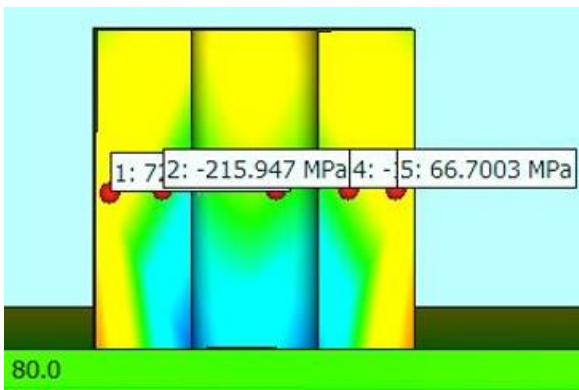
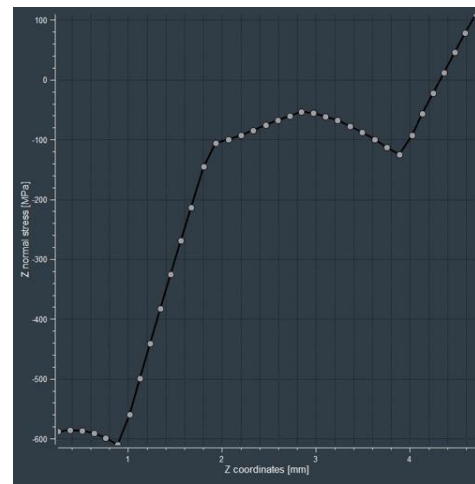
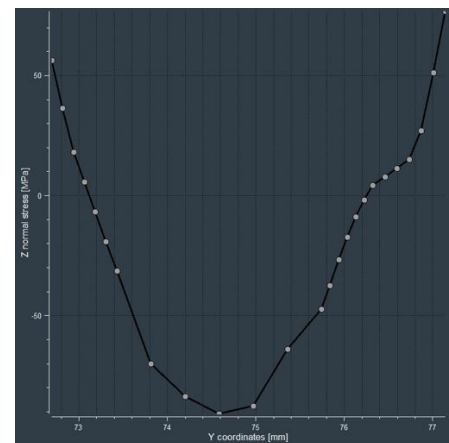
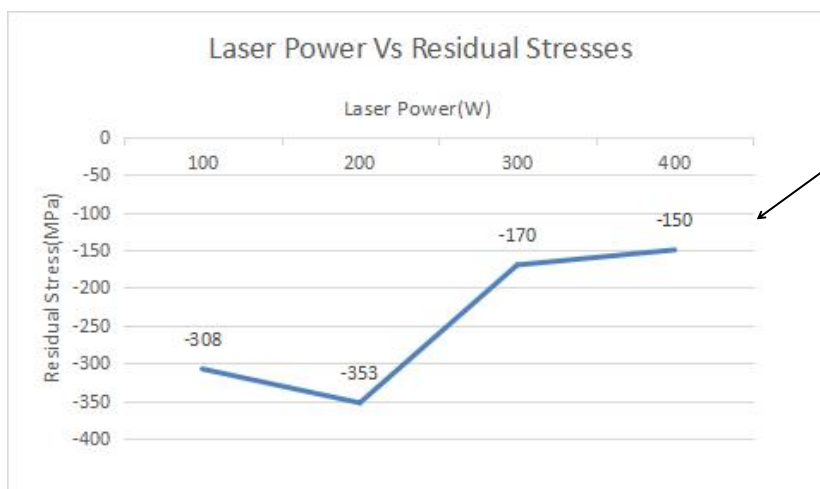


Fig.Z normal stresses in Z direction



Summary

	Power Input(W)	Coordinates(X,Y,Z)(mm)	Normal Stress(MPa)
Case1	100	75,75,2.7	-308
Case2	200	75,75,2.5	-353
Case3	300	75,75,2.568	-170
Case4	400	75,75,2.596	-150



As laser power increased, the compressive residual stresses decreased