



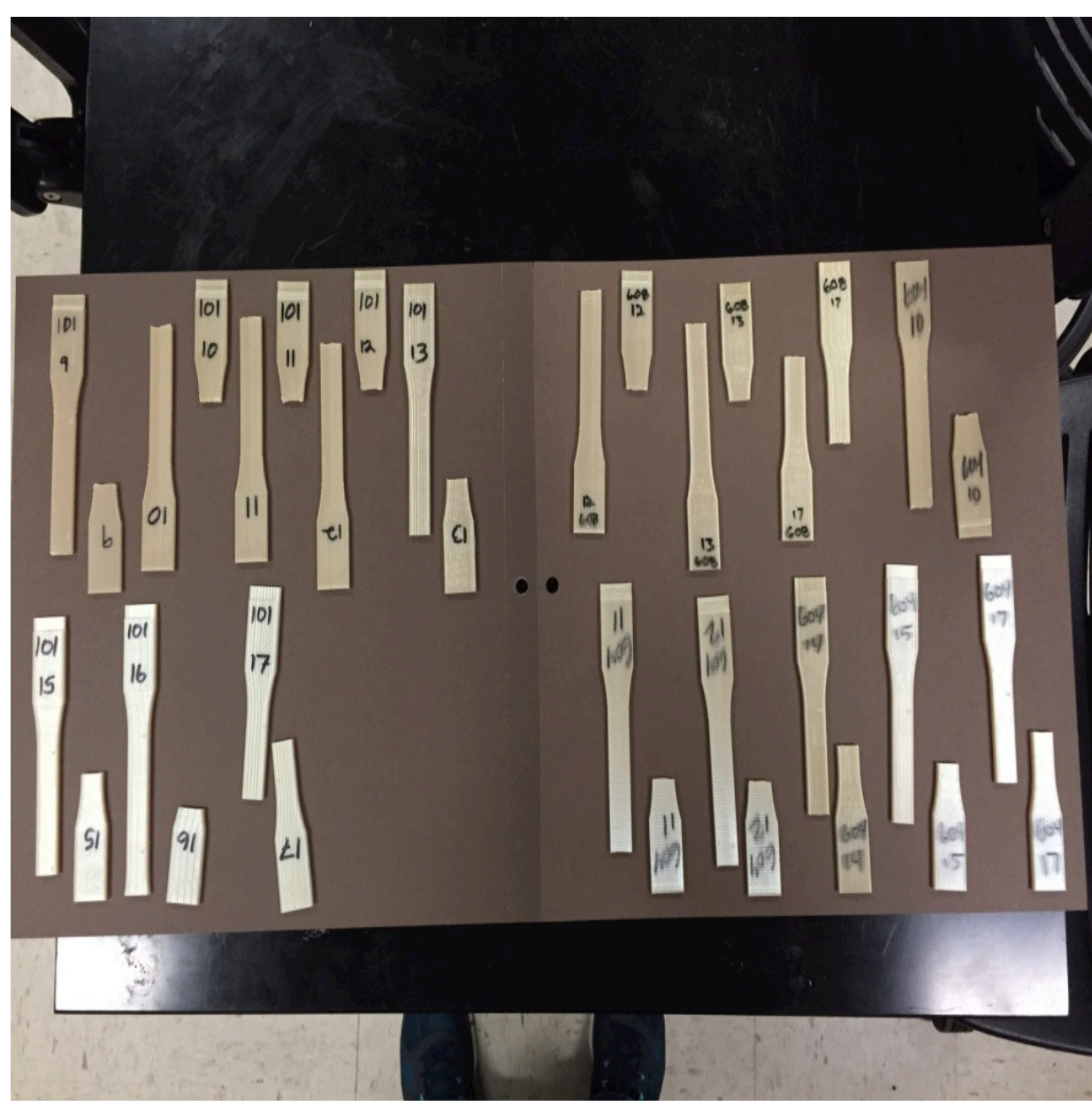
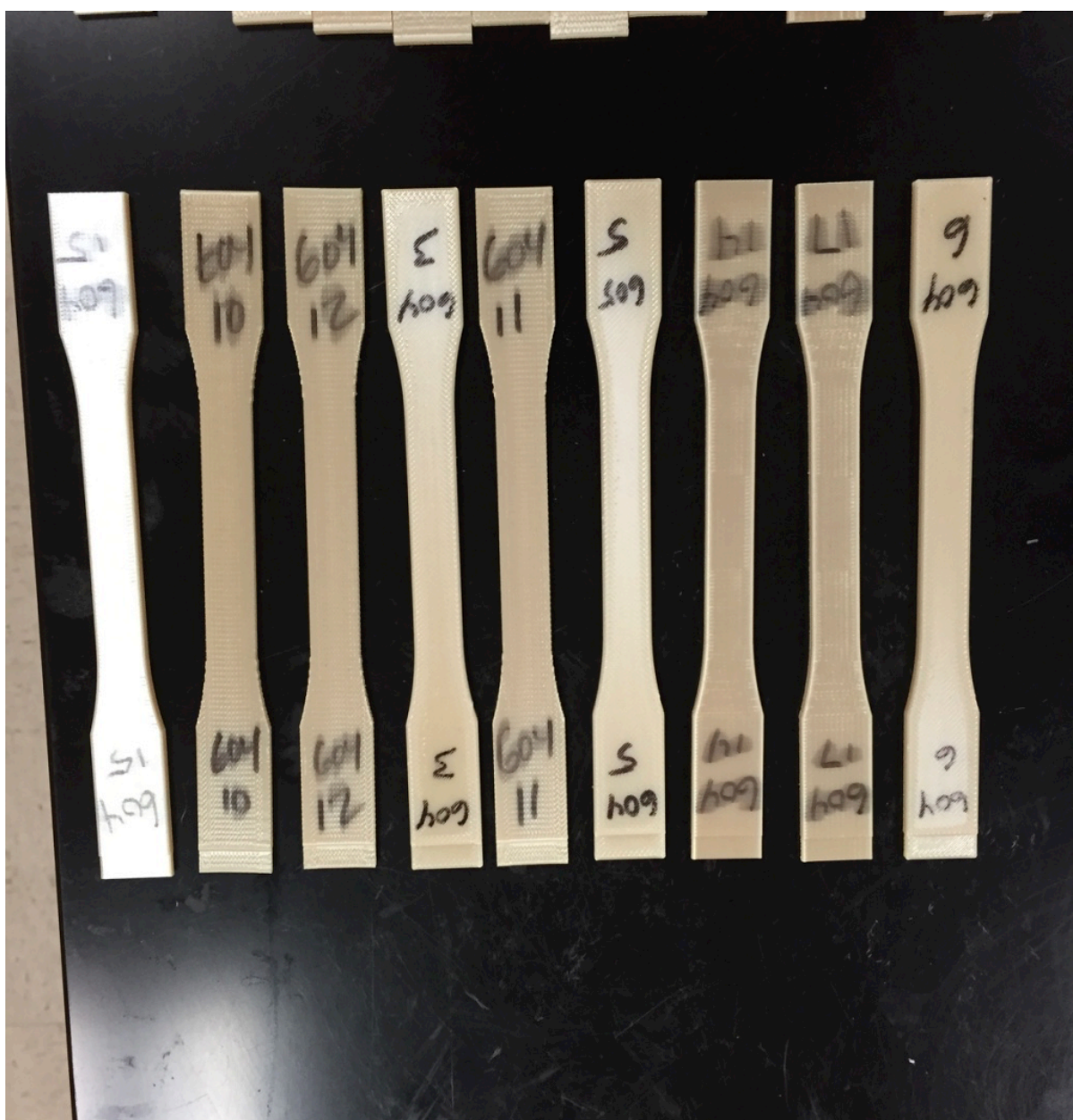
Tensile Properties of 3D Printed Materials

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Research Objective: Perform tensile testing of Fused Deposition Modeling materials to determine variability due to orientation and print machine.

Introduction:

- 3D printers can create the same product, but the orientation and printer may influence the variability of strength between identical products.
- The products tested were printed using the **Fused Deposition Modeling** process. (Stratasys FORTUS 900mc)
- The Ultem samples tested were produced on 6 different printers.
- There were three orientations tested; ZXY, YZX, and YXZ.



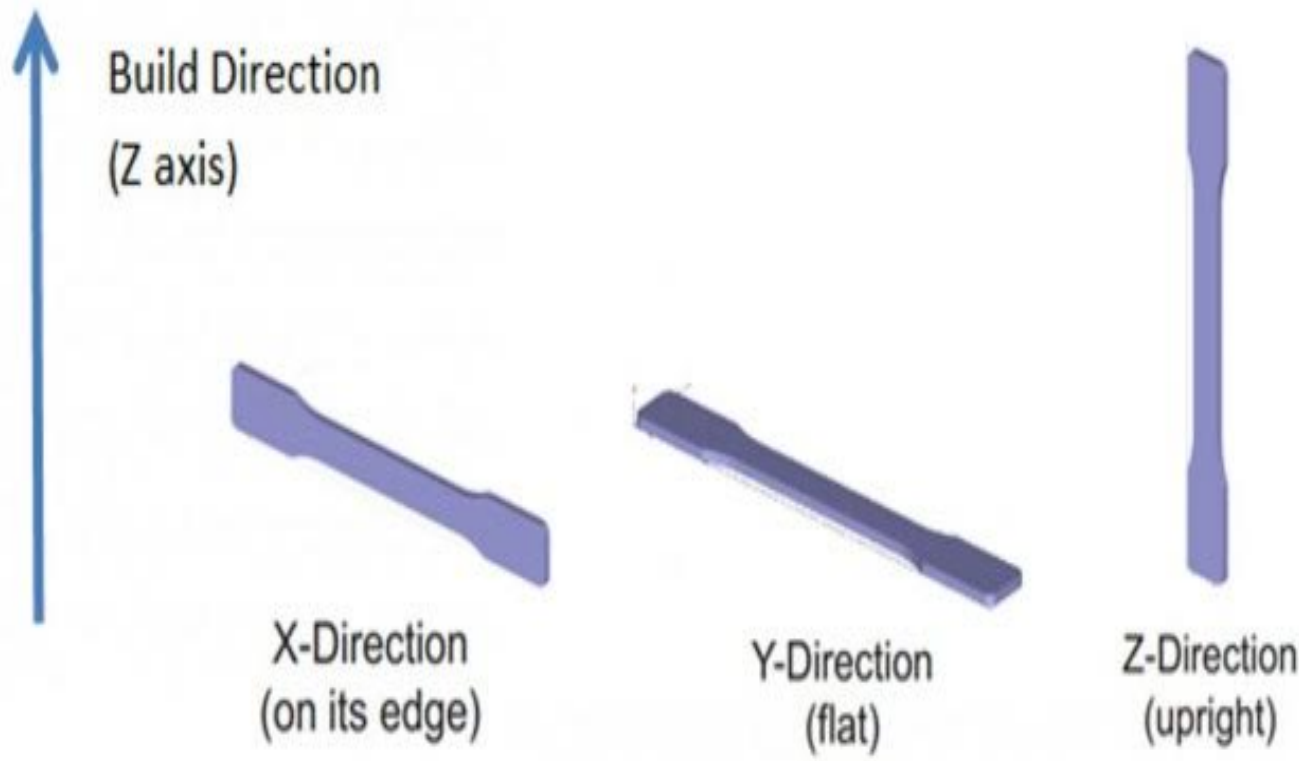
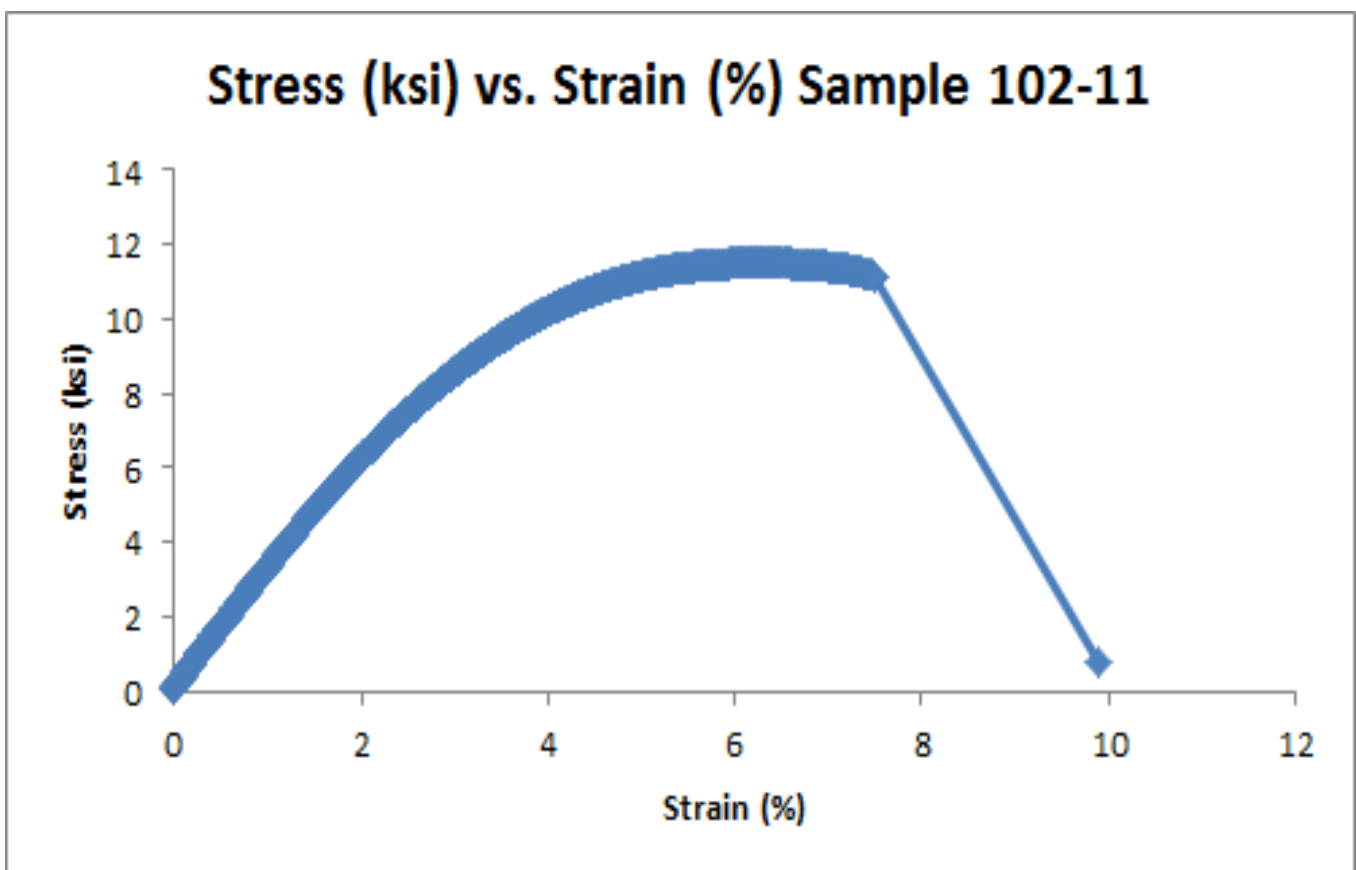
Methodology:

- Specimens were tested using ASTM 638 standards on an Instron 4486 using Bluehill software.
- All group members were involved in testing process which included sample testing, recording data, placing extensometer, analyzing data, and running Bluehill program.
- Testing procedures were completed on multiple days to include humidity, temperature, and human variability.

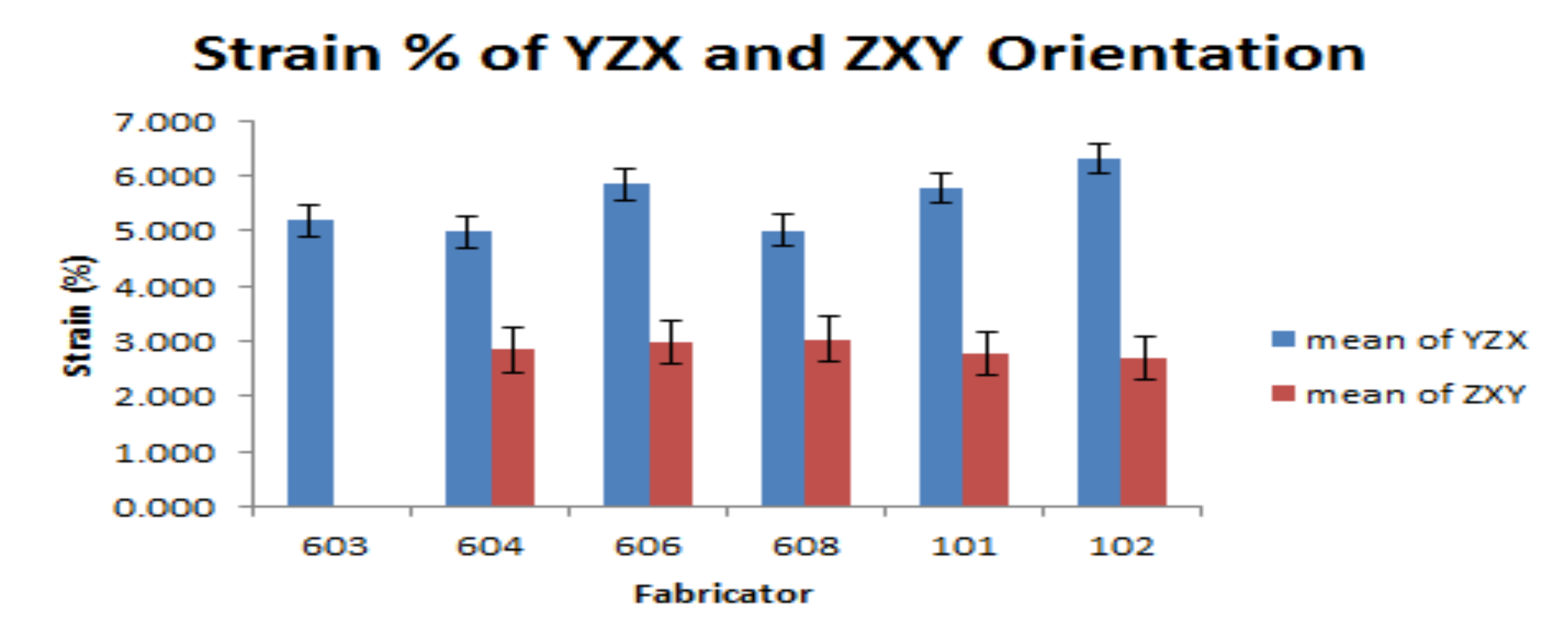


Analysis:

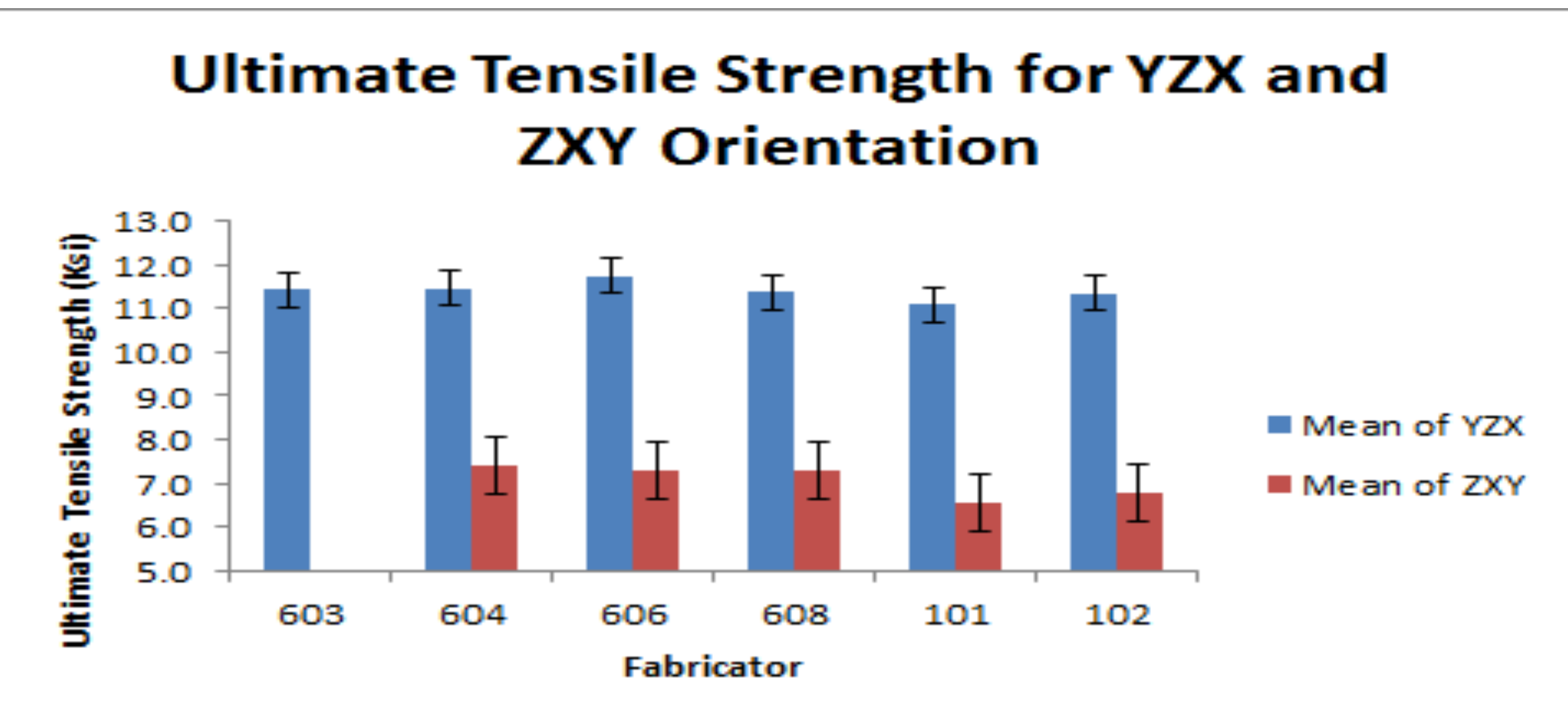
- Calculated the Ultimate Tensile Strength (UTS), Stress at Failure, Strain at Failure, and Elastic Modulus.



Strain at failure (%)



Ultimate Tensile Strength (ksi)



Conclusions:

- ZXY has the weakest UTS and smallest strain compared to YZX and YXZ orientation. YZX has the highest UTS and strain of all orientations tested.
- Statistically, each orientation from the various printers has similar tensile properties.