Affects of Infill Pattern & Percentage on Post-Annealing Dimensions of PLA & Carbon-PLA 3D Prints

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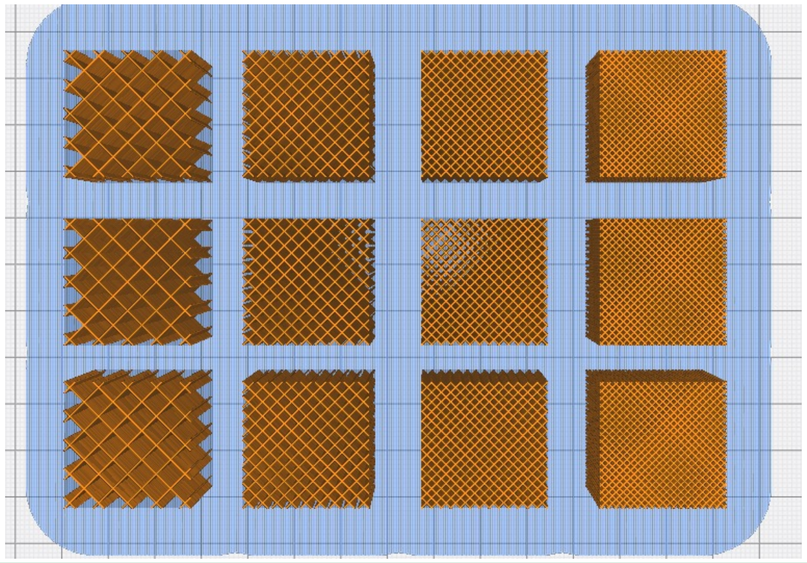
Background & Rationale

- In 3D printing, print *infill* can have a huge impact on the durability, flexibility, and weight of the print.[1]
- The two main components of an infill are the *pattern* and the *percentage* (how much of the inside the infill takes up).[1]
- *Material* also has an impact on how a print turns out. The most common material used is polylactic acid (PLA).[2]
- *Annealing* is the process of heating a material to a certain temperature to relieve internal stress.[3]
- When PLA is annealed the process can introduce new, additional stresses to the material.[4]
- Out of these three variables, I hypothesized that infill percentage would be responsible for the most post-annealing dimension change, therefore introduce the most stress.

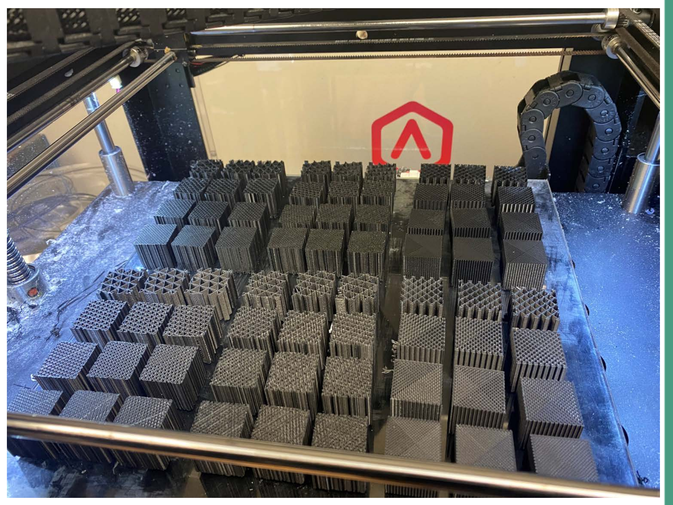
❖ The image below shows the differences between infill percentages for the grid pattern.



Methods

- All printing was done on a Raise 3D N2 Dual printer.
- Models: 25 x 25 x 25 mm PLA & Carbon-PLA cubes.
- Infill Patterns: Triangular, Tri-Hexagonal, Grid.
- Infill Percentages: 20%, 40%, 60%, & 80%.
- 3 models of each pattern/percentage were printed & the average dimensions were measured pre- & post-annealing.

❖ This image shows all printed models before annealing.

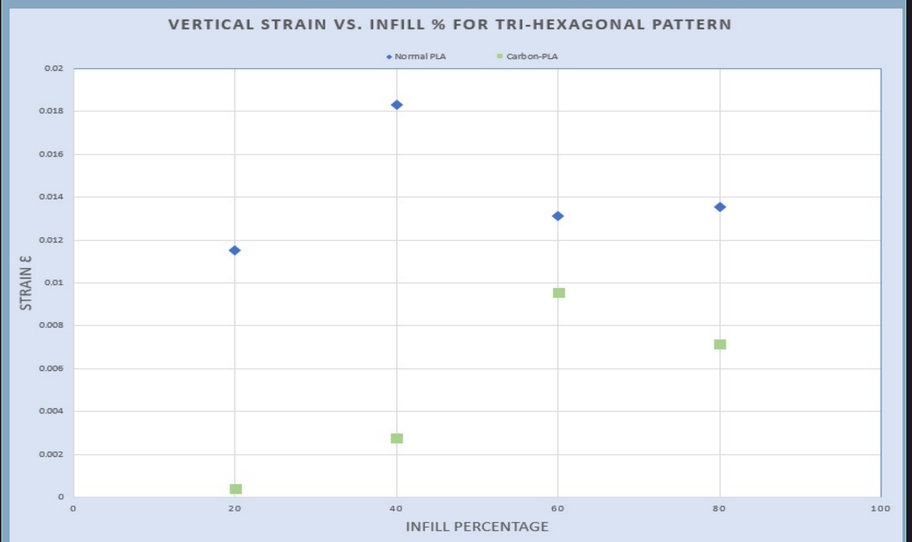


- Bed temp, nozzle temp, printing speed, flow, & annealing temps were the same for each batch.
- Models were annealed at 95°C overnight.

Results & Analysis

- Out of the three variables, material affected the strain of the prints the most.

❖ The graph below is one sample of the data collected; depicting only the strain in the z-direction of the prints.



Conclusions & Further Research

- Further study of the strains from these specific samples will be done.
- Other stresses, like tensile or compression stress, should be tested in the future.

References

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