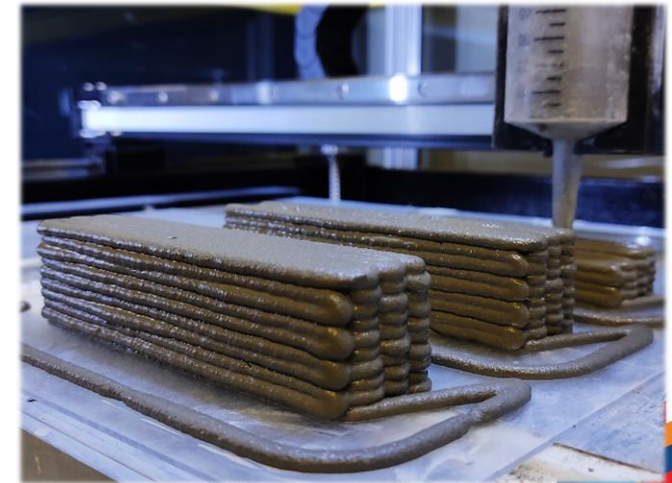
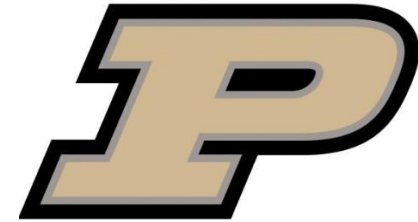


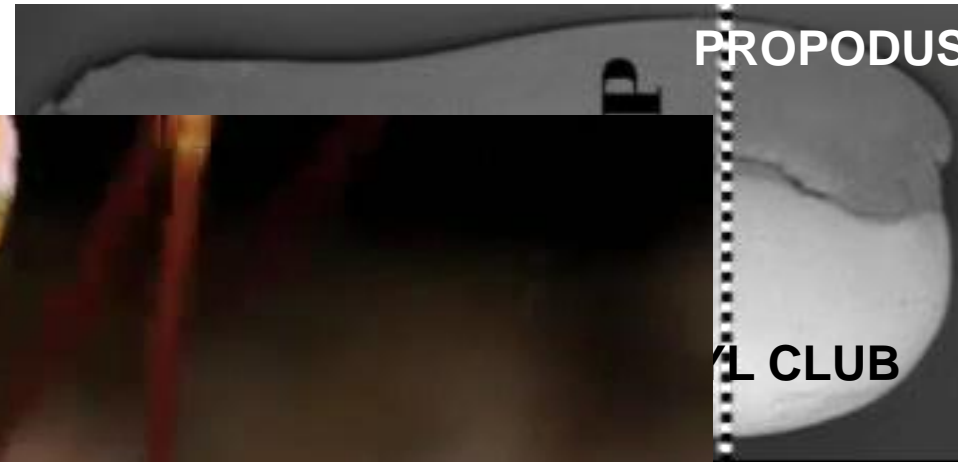
Nonplanar Layering of Filaments and Sinusoidally Architected

Structures in 3D-printed Cementitious Materials

Yu Wang, Fabian B. Rodríguez, Dr. Ala Eddin Douba,
Prof. Pablo D. Zavattieri, Prof. Jan Olek, Prof. Jeffrey P. Youngblood



Motivations-Stomatopod Dactyl Club

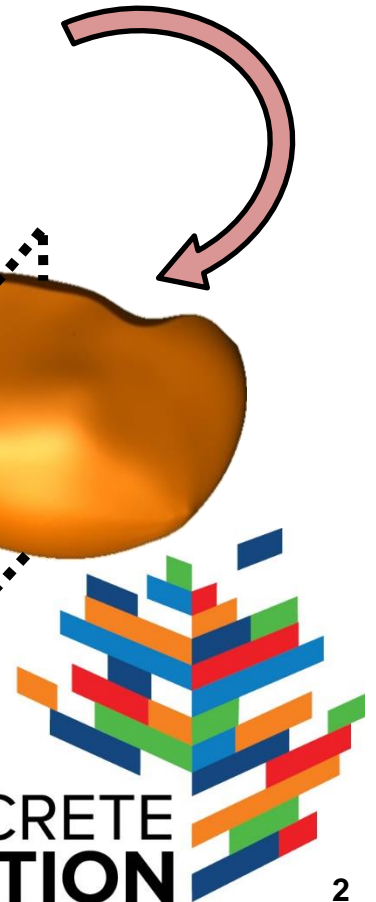


PROPODUS

DACTYL CLUB

DACTYL CLUB

TRANSVERSE SECTION



J. Weaver et al., Science, 2012. 336(6086): p. 1275-1280

Suksangpanya et al., Journal of the behavior of biomedical materials, 2017, 10, pp.50-57

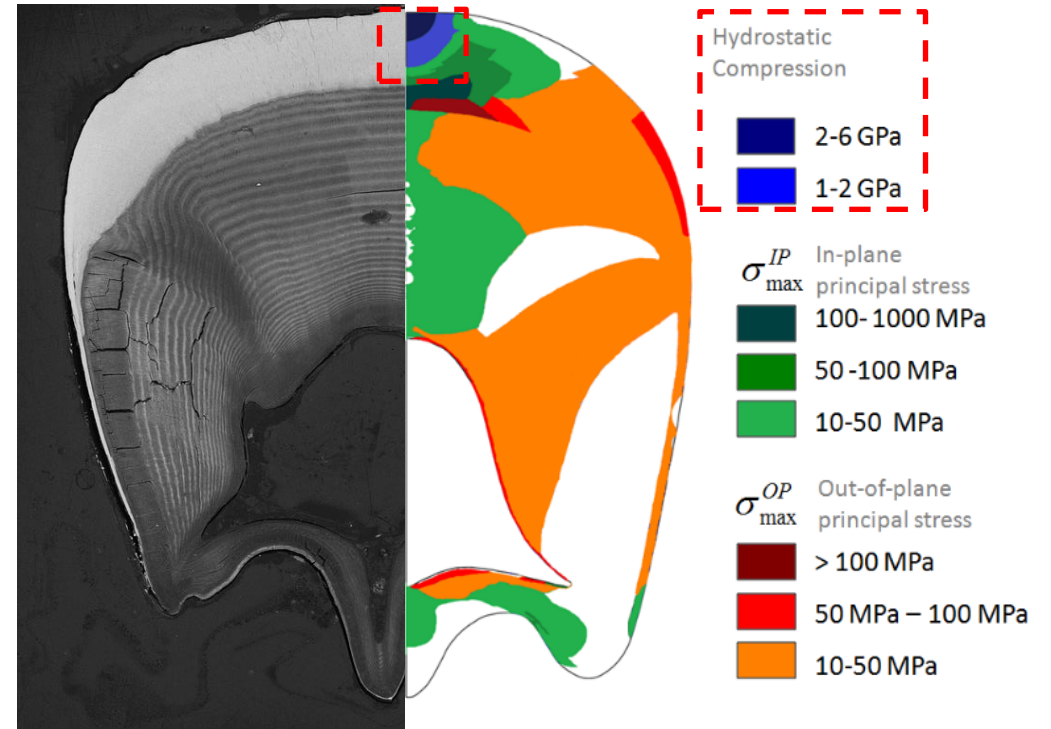
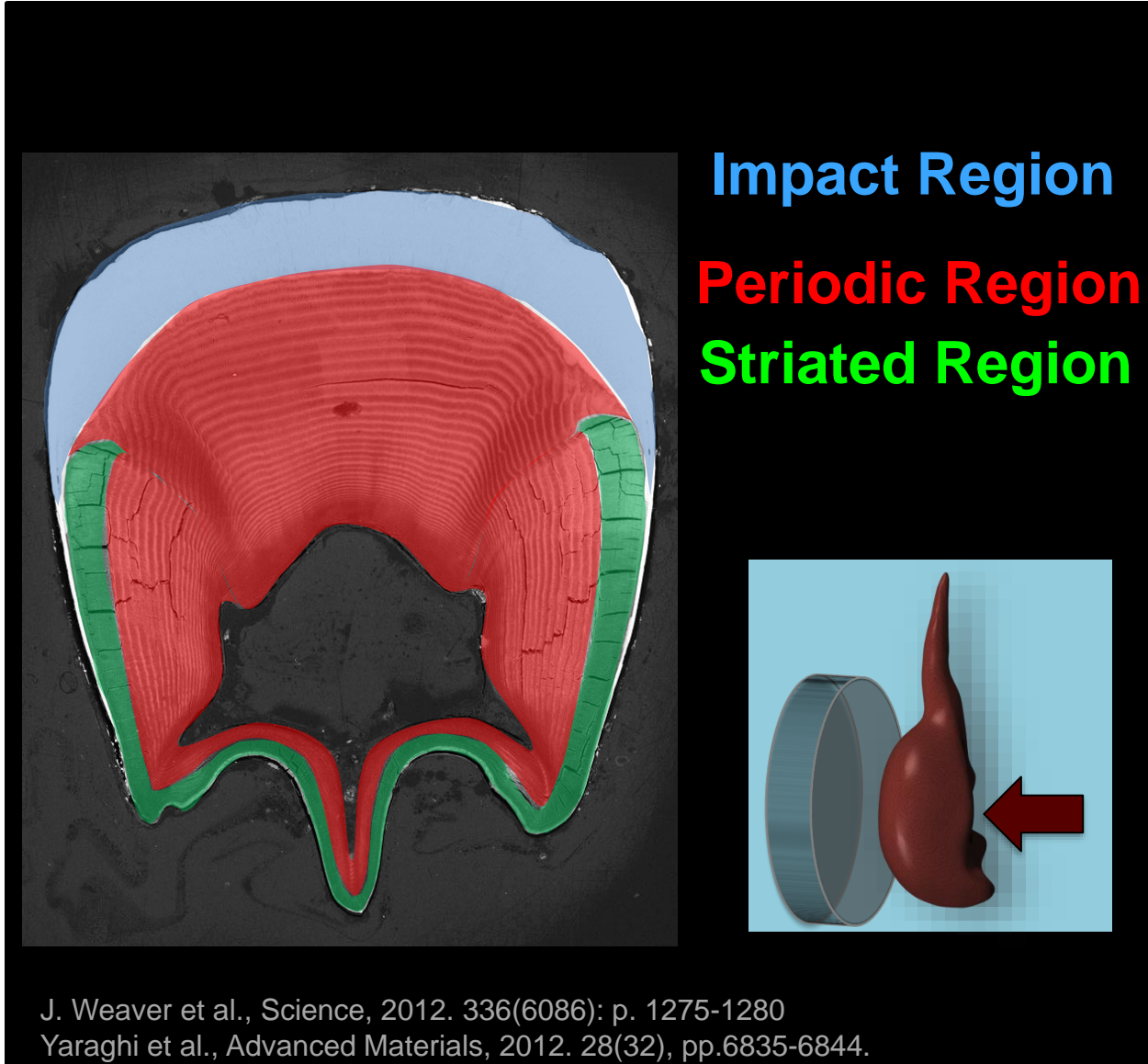


The Secret Life of Predators
http://education.nationalgeographic.com/education/media/peacock-mantis-shrimp/?ar_a=1

THE WORLD'S GATHERING PLACE FOR ADVANCING CONCRETE

aci CONCRETE CONVENTION

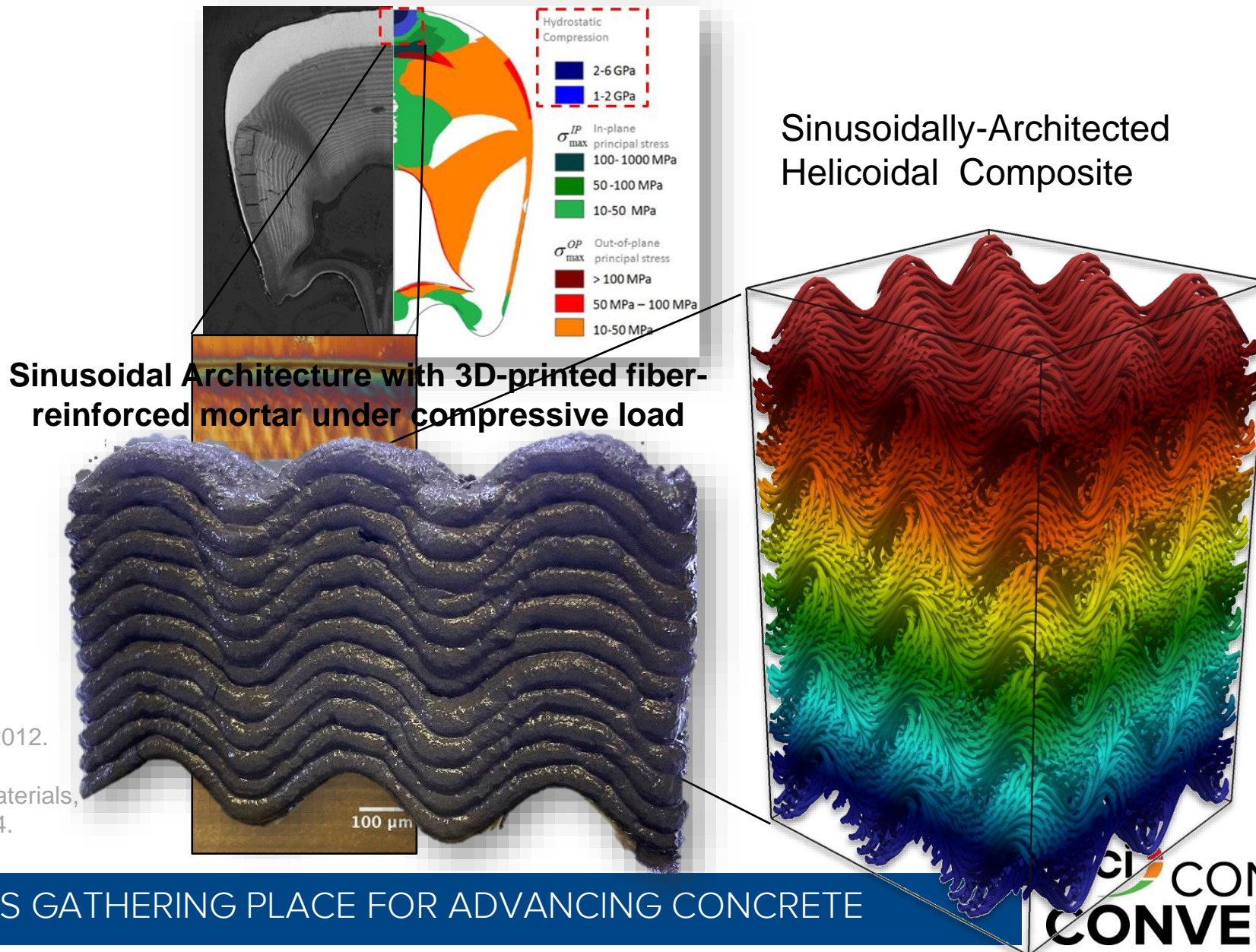
Motivations-Stomatopod Dactyl Club



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Motivations-Stomatopod Dactyl Club



J. Weaver et al., Science, 2012. 336(6086): p. 1275-1280
Yaraghi et al., Advanced Materials, 2012. 28(32), pp.6835-6844.

THE WORLD'S GATHERING PLACE FOR ADVANCING CONCRETE

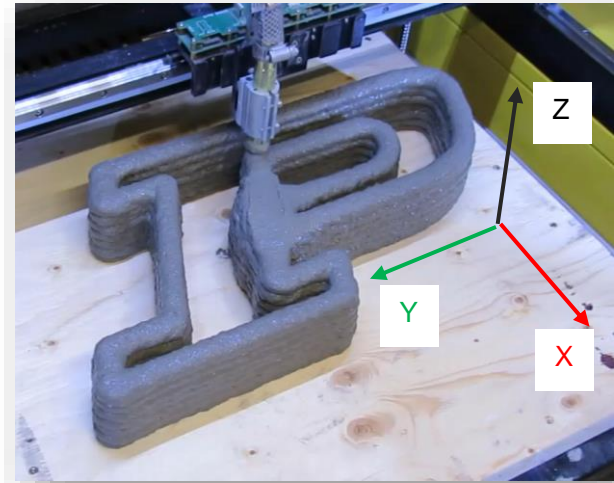
CONCRETE CONVENTION



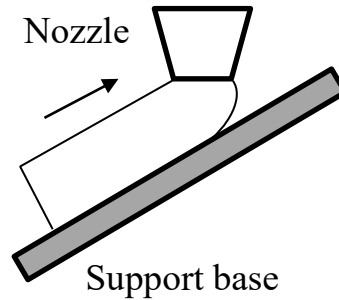
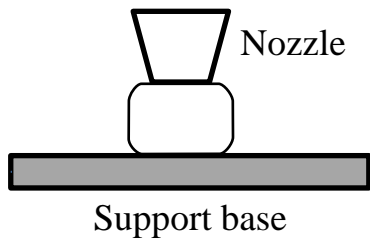
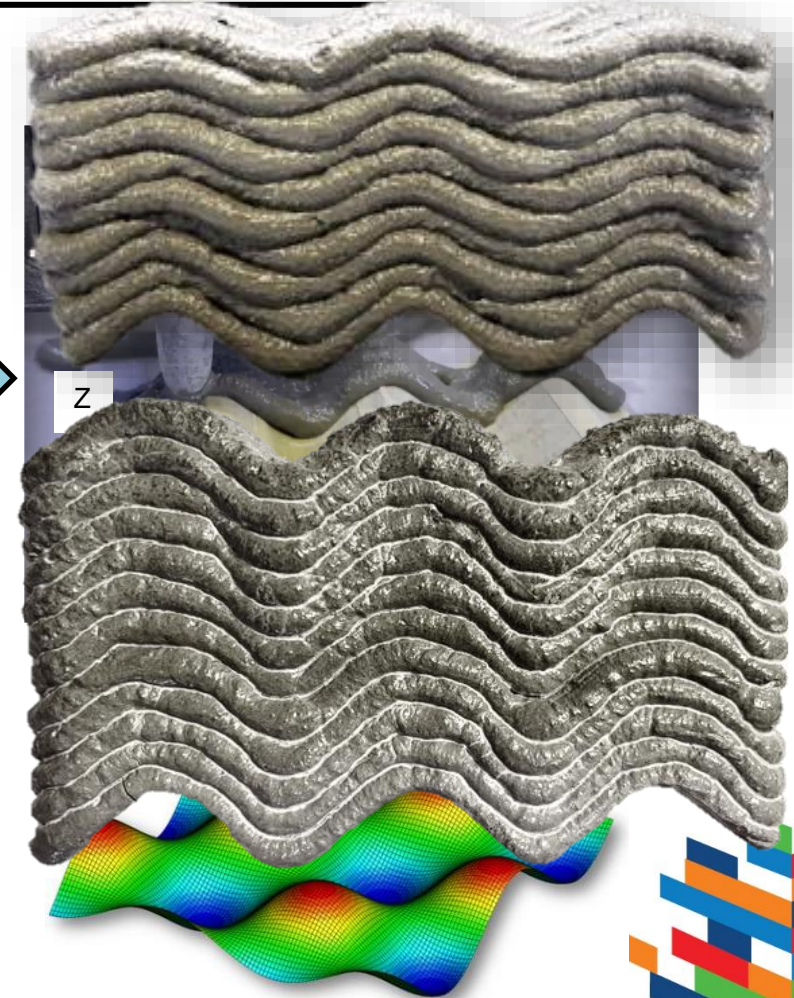
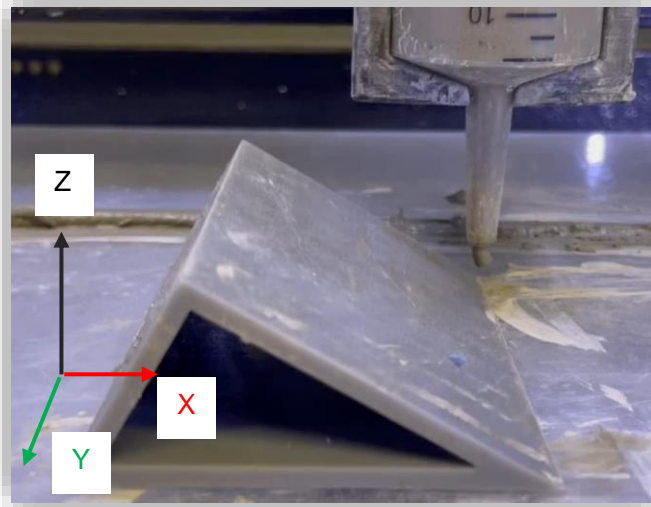
Nonplanar Layering of Filaments

Nonplanar Layering of Filaments(Active X-Z printing)

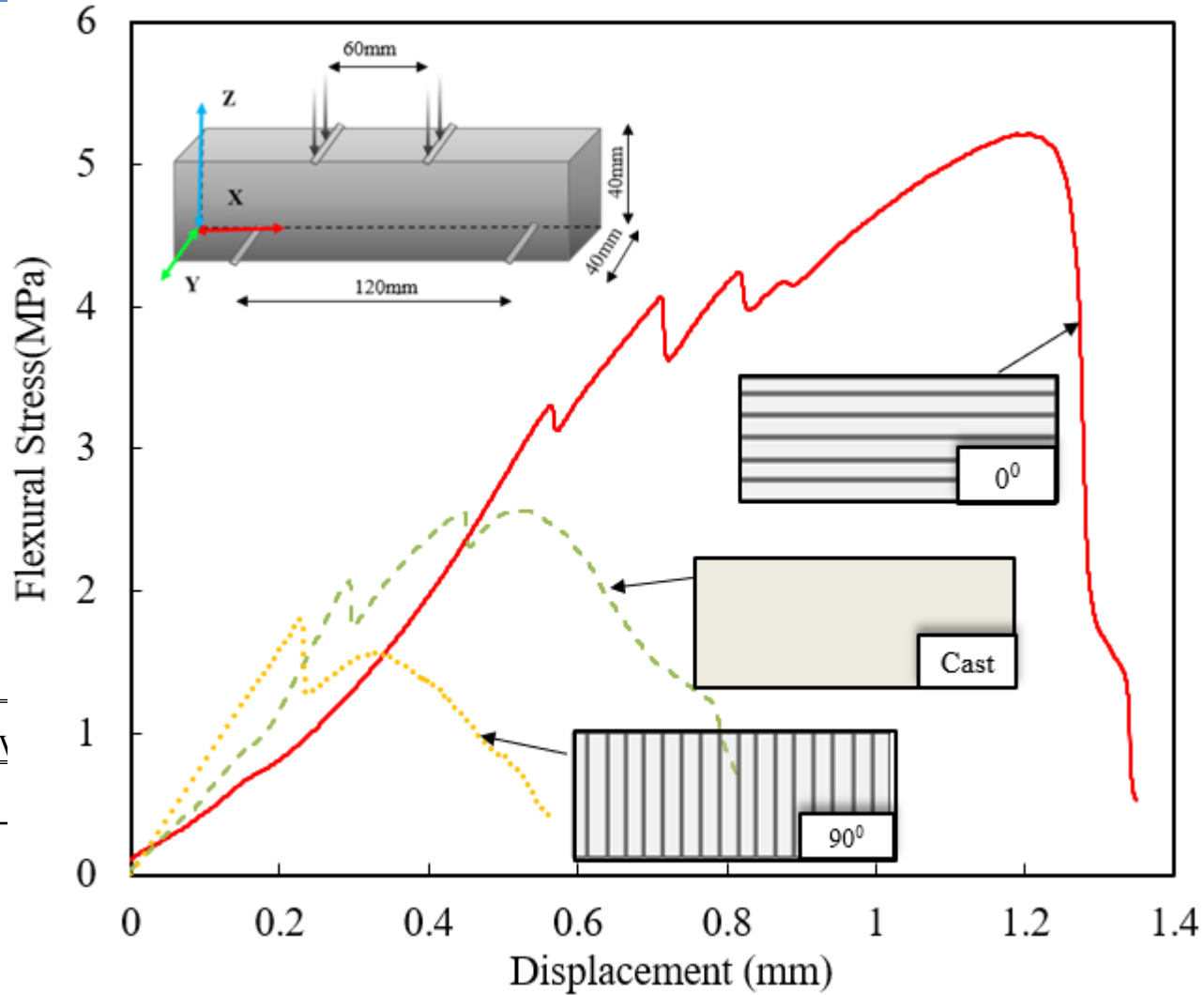
Printing on a flat surface
(Active X-Y printing)



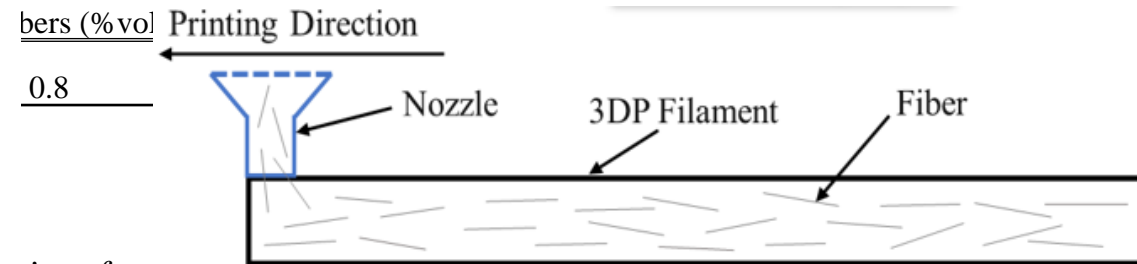
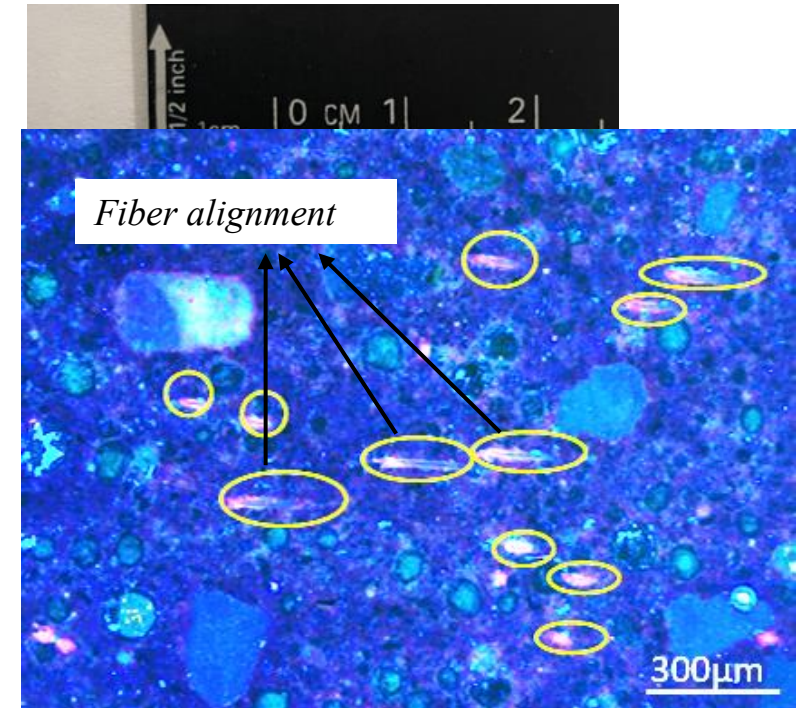
1-D incline surface



Experimental program



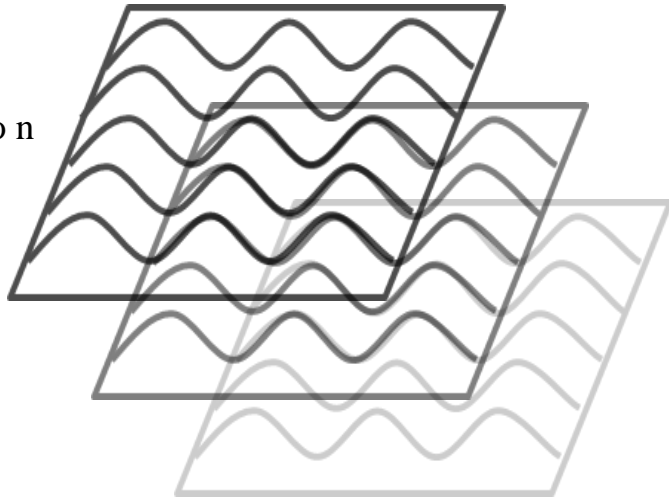
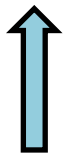
0.6mm was used in this study.



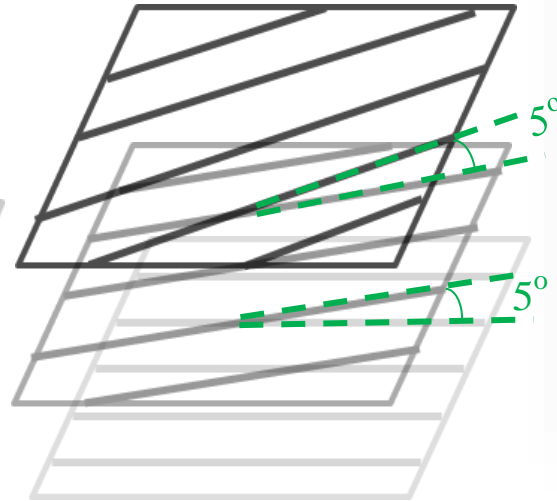
Experimental program

J. Weaver et al.,
 Science, 2012.
 336(6086): p. 1275
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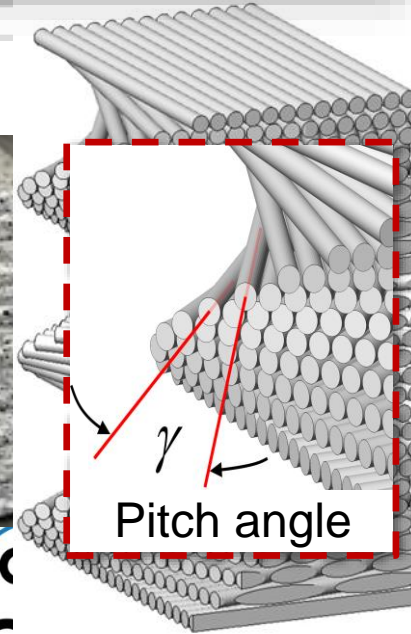
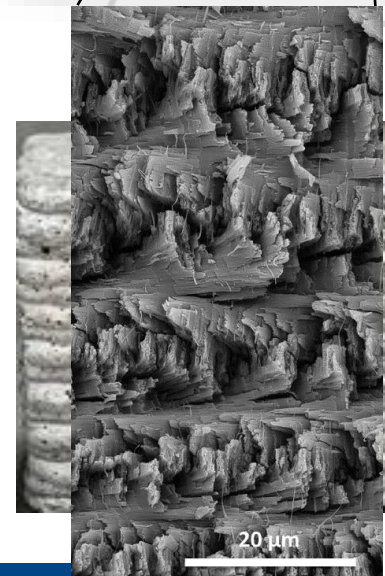
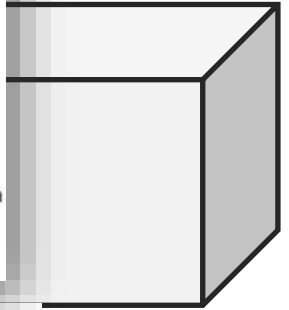
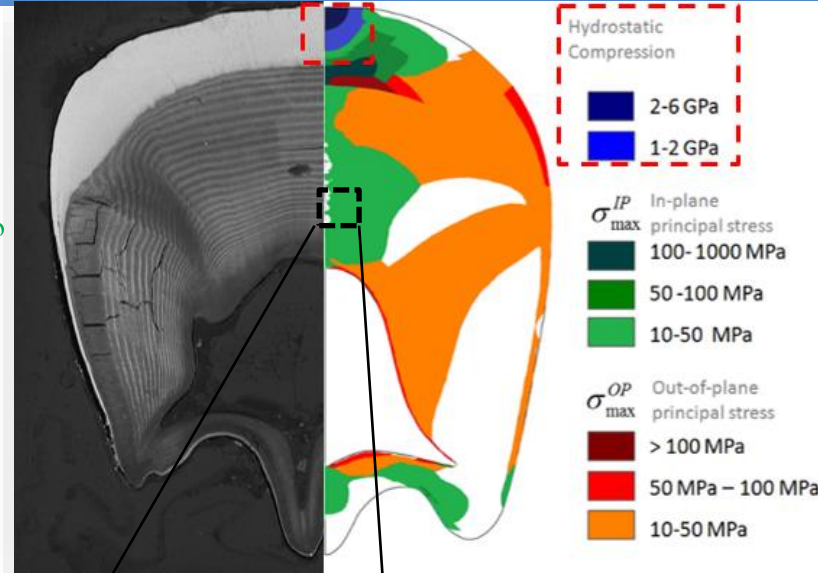
Layer 1 to n



Sin

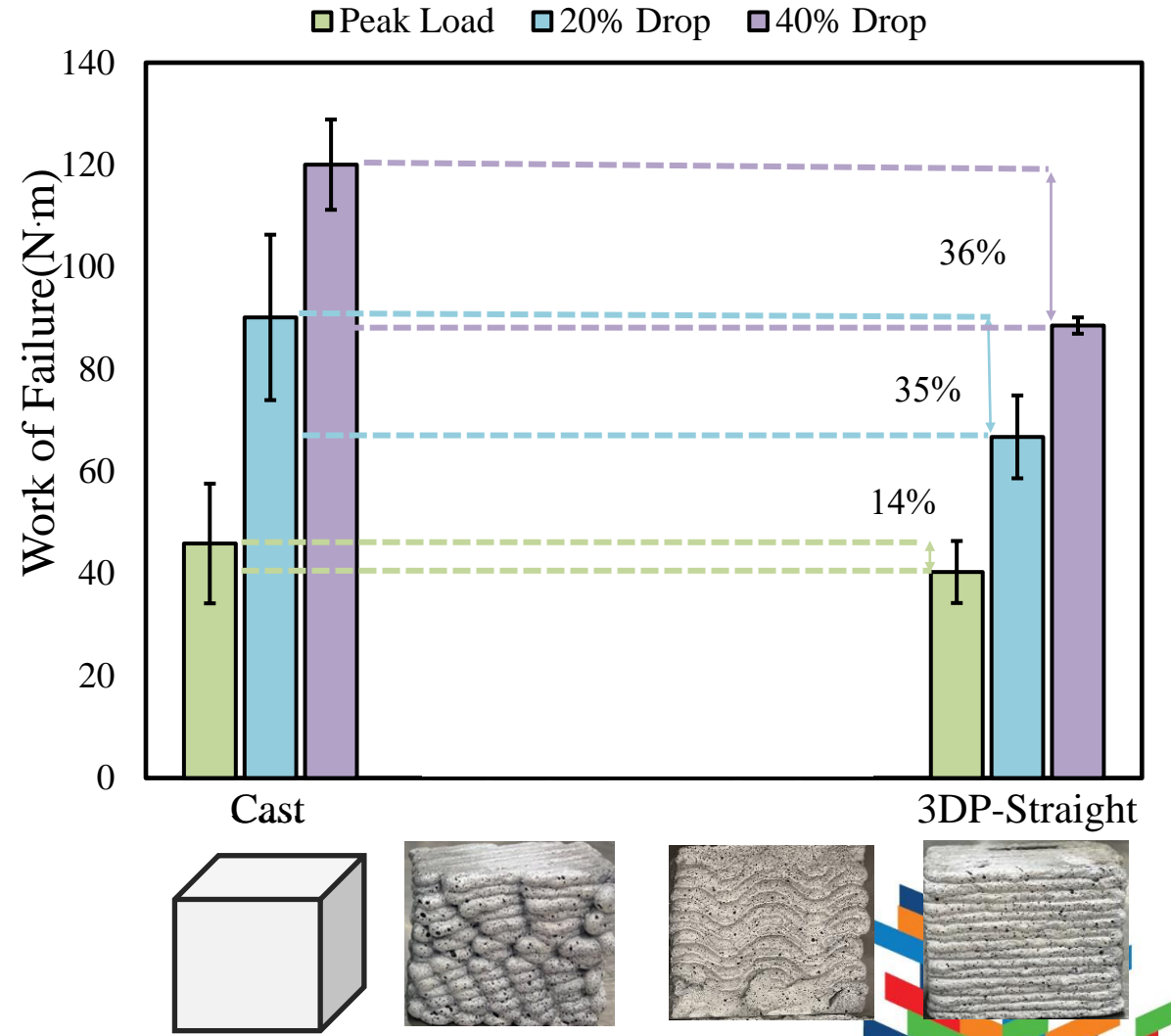
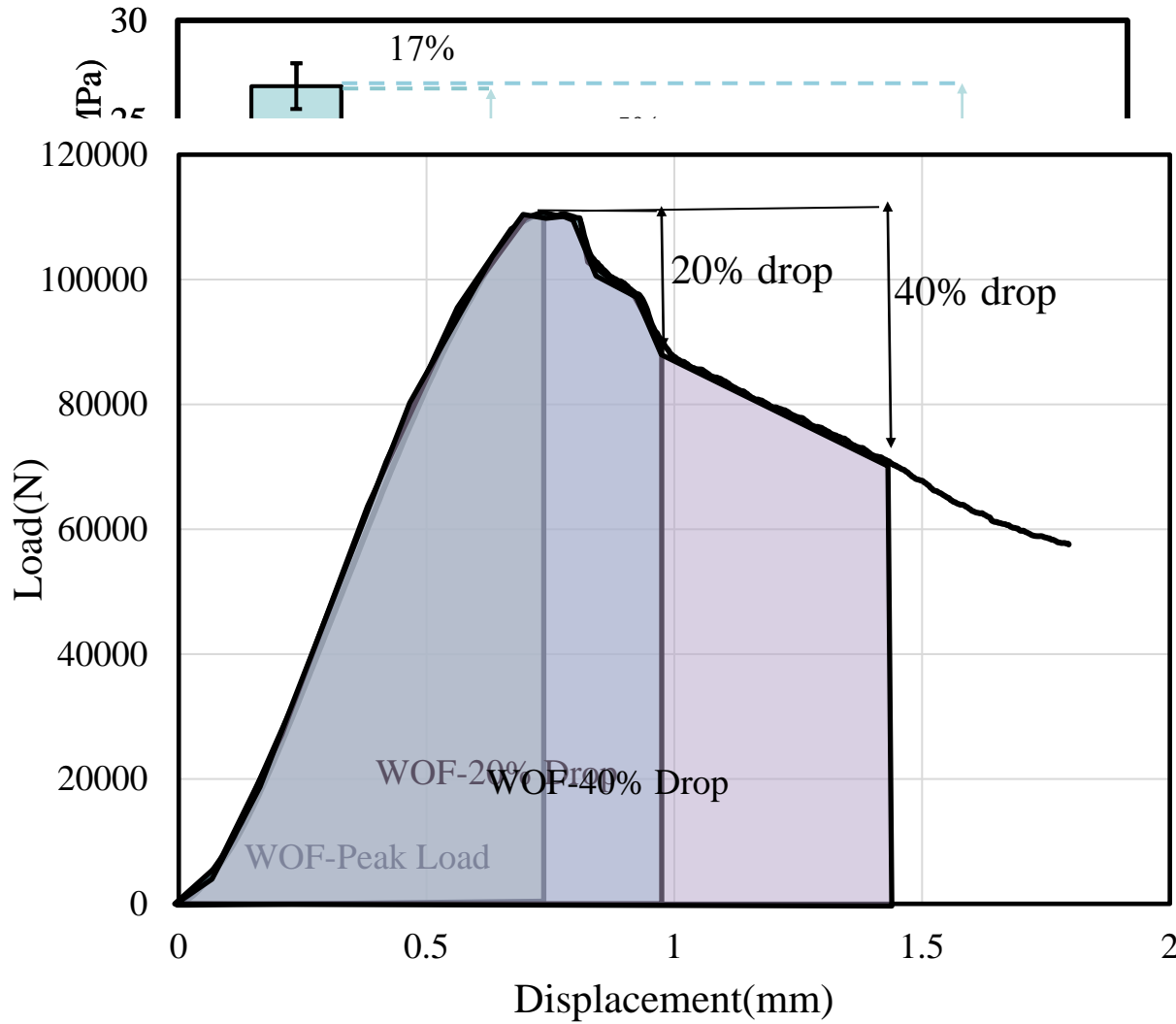


Bu-5



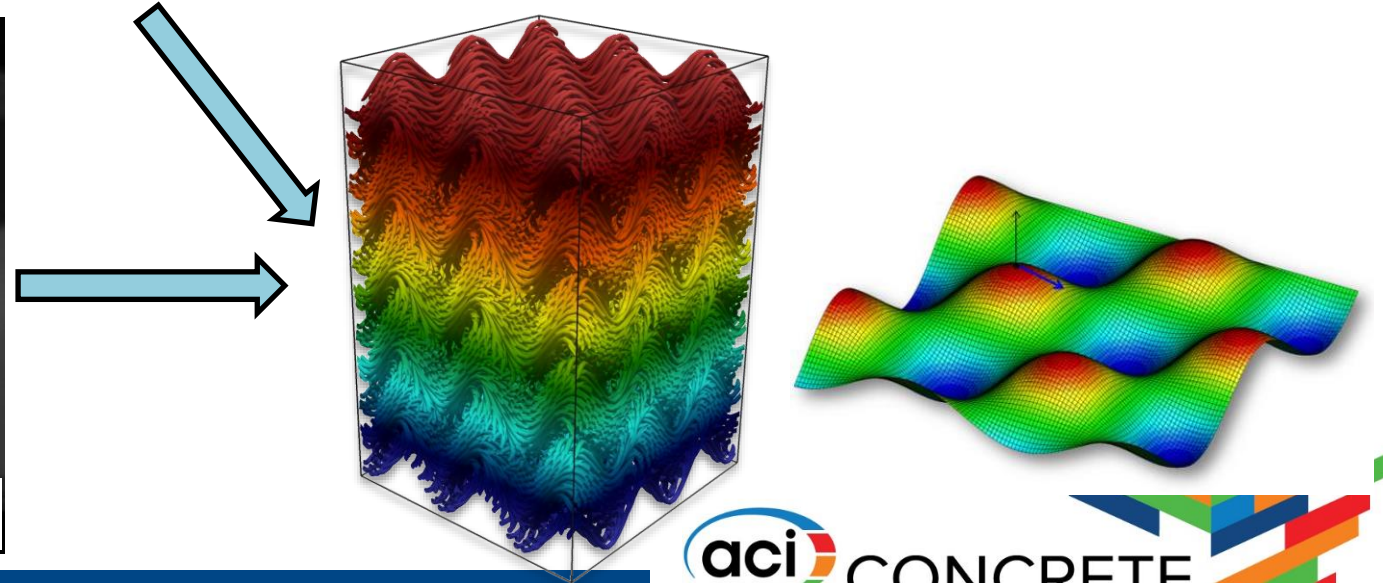
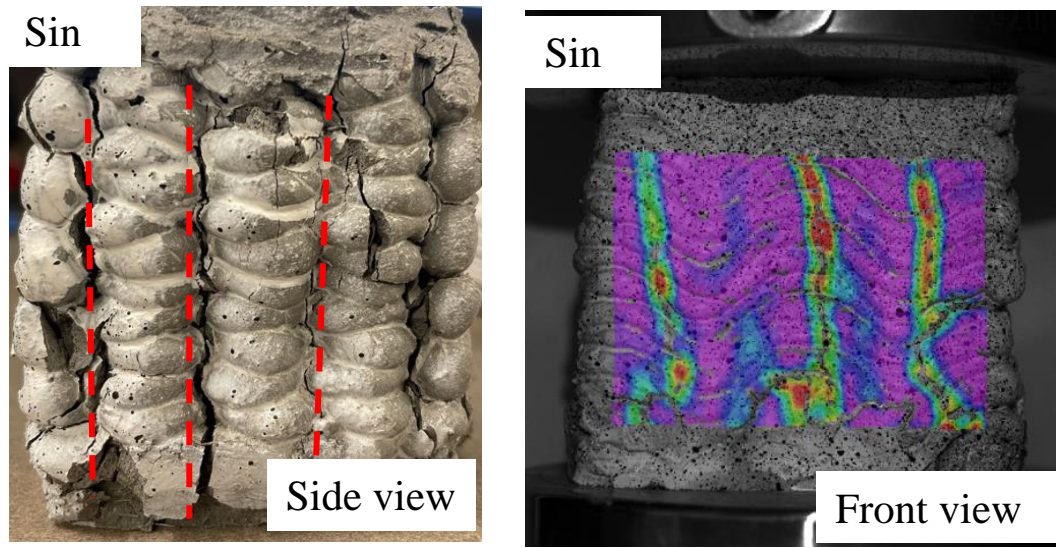
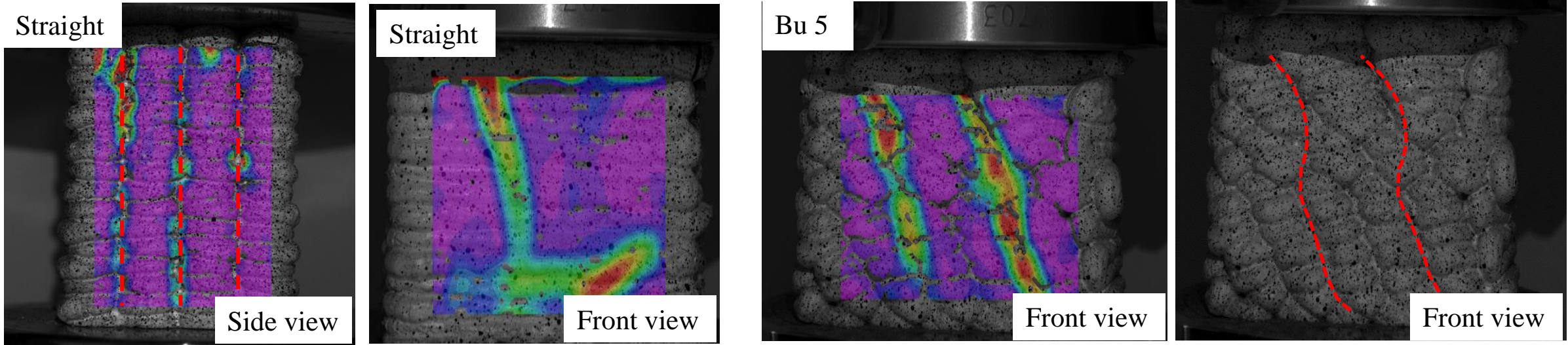
Cast

Results



Results and Conclusions

DIC principal strain concentration contour and crack development



THE WORLD'S GATHERING PLACE FOR ADVANCING CONCRETE



Prof. Pablo Zavattieri



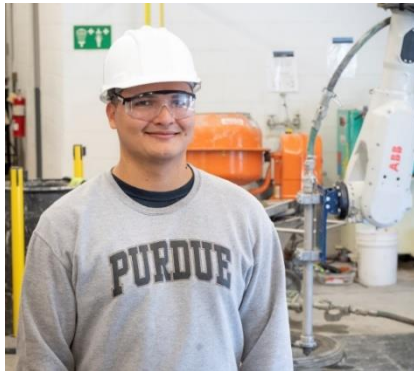
Prof. Jan Olek



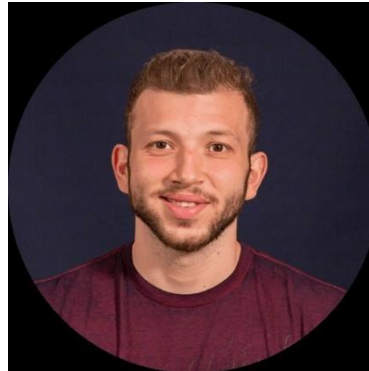
Prof. Jeffrey P. Youngblood



Yu Wang



Fabian B. Rodríguez



Dr. Ala Eddin Douba

Thank you

Yu Wang

wang4648@purdue.edu



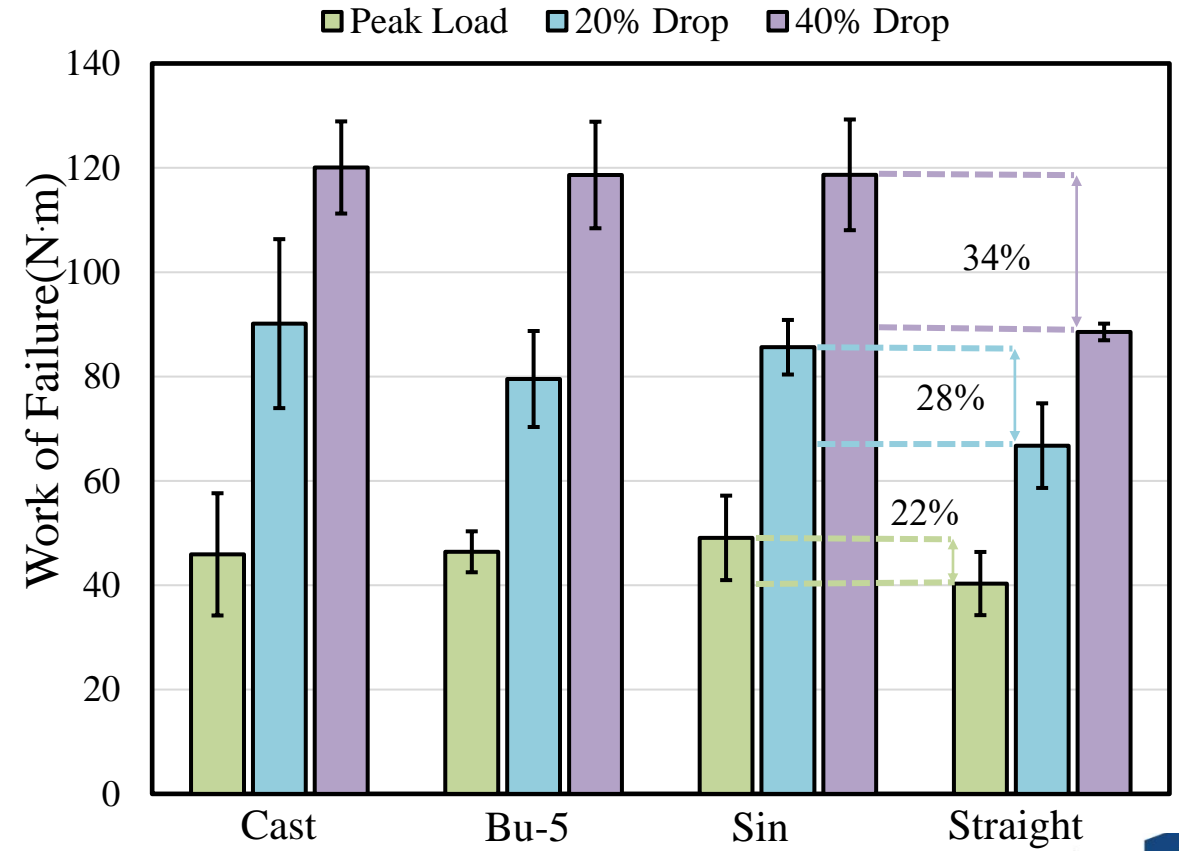
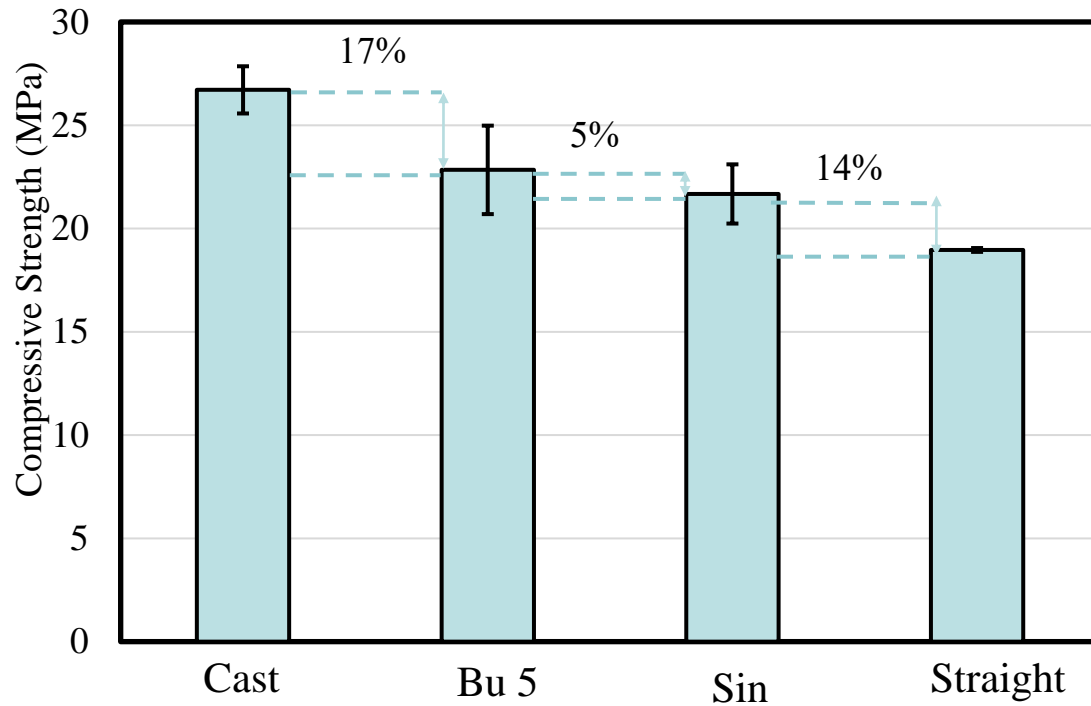
aci CONCRETE CONVENTION

THE WORLD'S GATHERING PLACE FOR ADVANCING CONCRETE

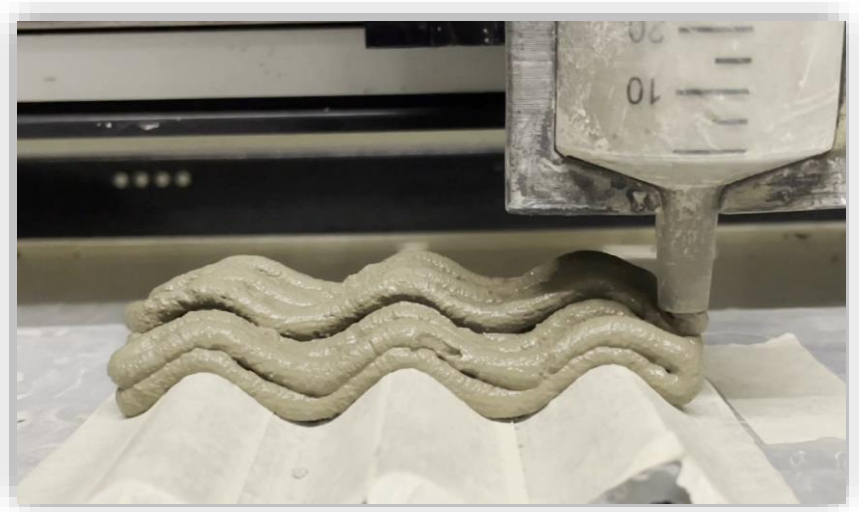
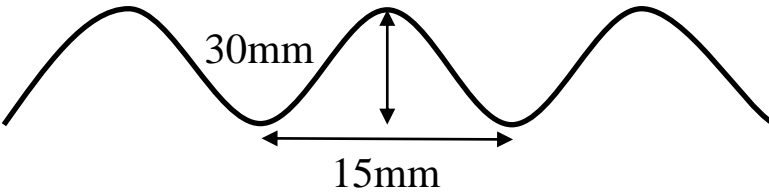
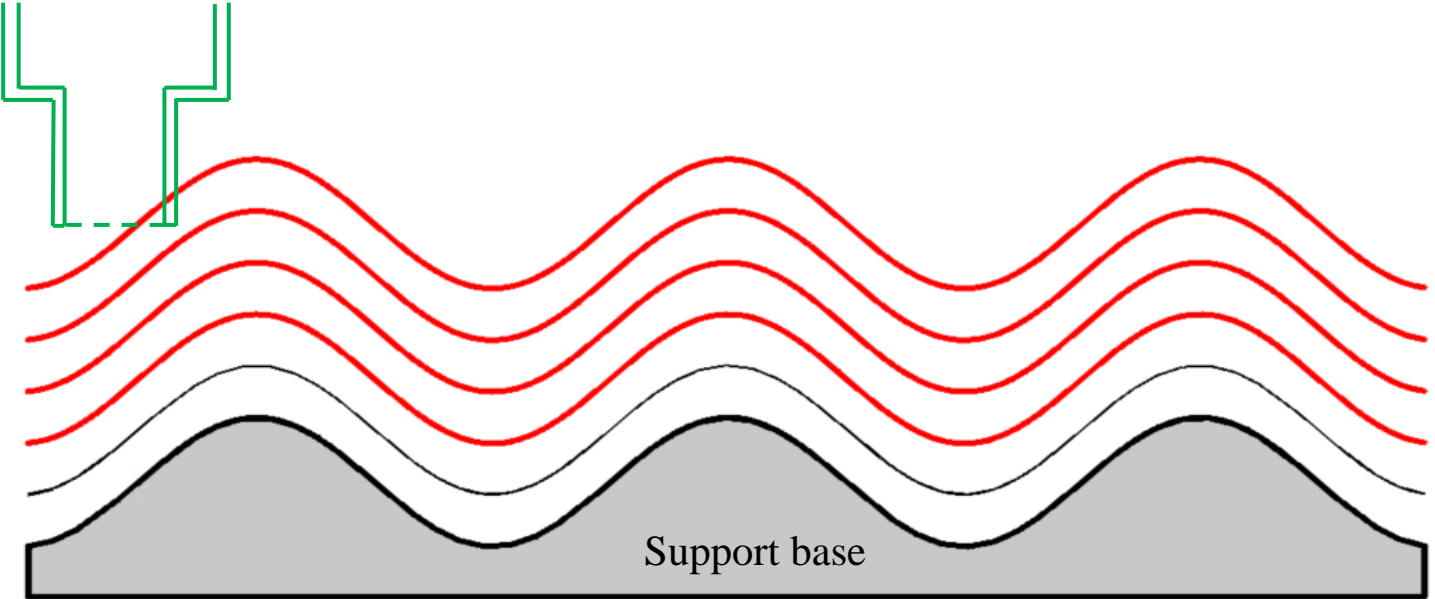
THE WORLD'S GATHERING PLACE FOR ADVANCING CONCRETE

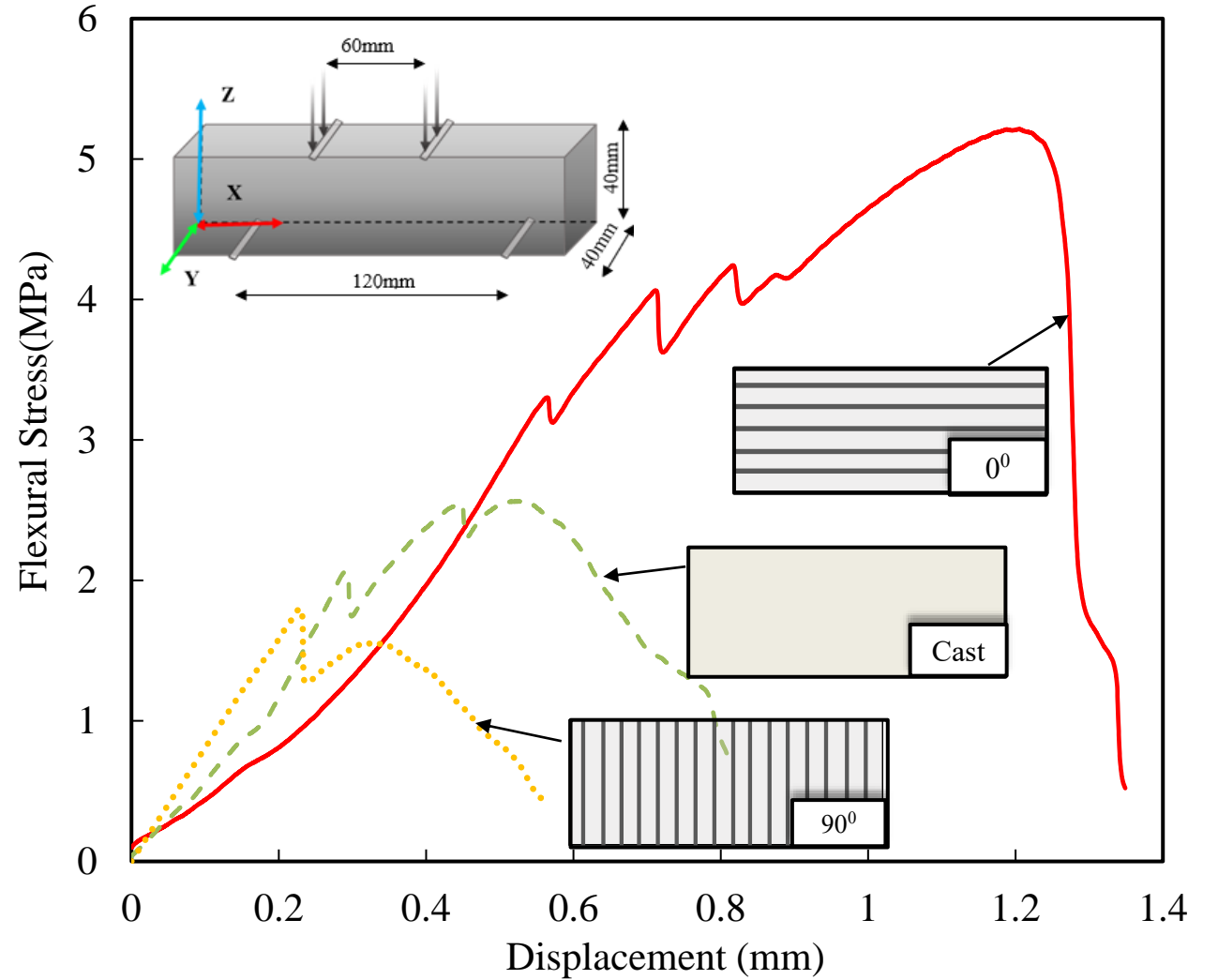
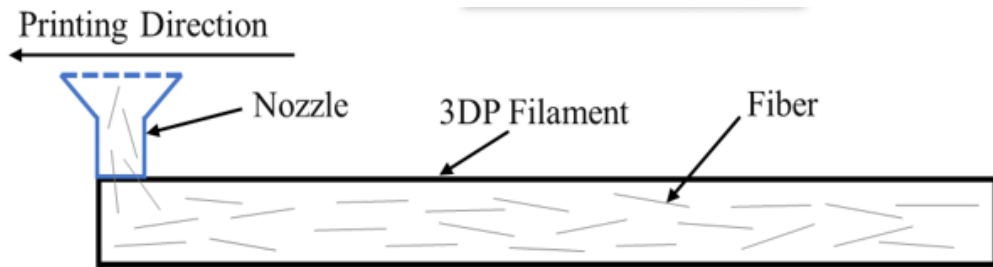
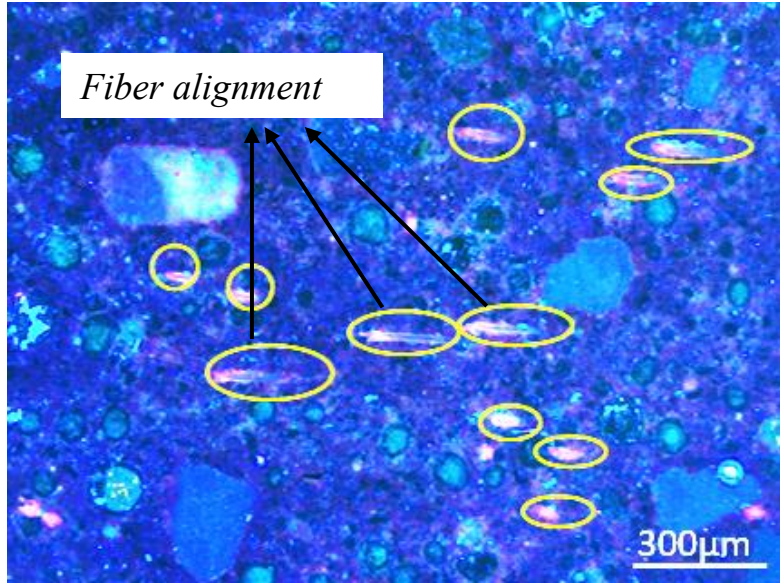


Compression test



Nonplanar Layering of Filaments





Reference

- [1]Weaver, J.C., Milliron, G.W., Miserez, A., Evans-Lutterodt, K., Herrera, S., Gallana, I., Mershon, W.J., Swanson, B., Zavattieri, P., DiMasi, E. and Kisailus, D., 2012. The stomatopod dactyl club: a formidable damage-tolerant biological hammer. *Science*, 336(6086), pp.1275-1280.
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