

Soft coring: How to get a clarinet out of a flute?

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Cutting mozzarella with a dull blade results in poorly shaped slices [1]: the process occurs in a configuration so deformed as to yield unexpectedly curved surfaces. We study the morphogenetics arising from such process through the example of coring [2]: when a thin cylindrical hollow punch is pushed into a soft elastomer, the large transverse expansion occurring during the cutting is responsible for the “clarinet-shape” of the extracted core, which reaches diameters far smaller than those of the tool (Fig. 1 (a)).

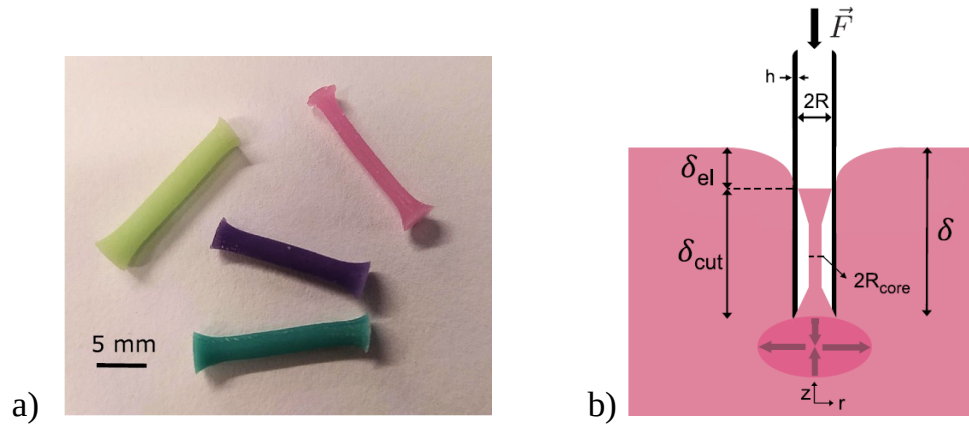


Figure 1. (a) Some examples of clarinet-shaped cores. (b) Sketch of the coring mechanism.

With contributions from fracture mechanics and large strain theory [3], we build a simple yet quantitative understanding of the observed discrepancy, which is shown to occur when the size of the punch is smaller than a characteristic, tomo-elastic length scale [2]. Moreover, material nonlinearity and friction appear to play a crucial role in this phenomenon [4].

References

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