# PRELIMINARY APPROACH OF AN ALTERNATIVE SOLUTION FOR THE BREAST IMPLANT SHELL

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## Introduction

In 2020, breast augmentation was the most performed plastic surgical procedure worldwide [1]. Even though silicone implants are the gold standard, different factors might lead to implant failure, including mechanical loading. This was proved by our group, concluding that fatigue damage can be a potential cause of the in vivo failure [2]. Moreover, another major complication related to breast implants is capsular contracture, which might cause implant distortion, breast pain and poor aesthetic outcome [3]. To address this issue, most implants are manufactured with a textured surface, which is currently done by using calibrated salt grains [3] or through a negative-contact imprint of polyurethane foam [4]. As an alternative, in this work, a different texture is produced using an impression technique and its mechanical properties are investigated.

## Methods

The textured surface was obtained through a PLA (polylactic acid) texture stamp and an alginate sheet. Firstly, a PLA stamp (Figure 1a) was printed using an Ultimaker 3 printer. Secondly, an alginate solution was poured over the mold and smoothed, being then crosslinked with 50 mM $CaCl_2{\cdot}2H_2O$ (Calcium chloride dihydrate) for ≈1h. The sheet of alginate was then used to stamp the PDMS (polydimethylsiloxane, SYLGARD™ 184), which was prepared in a ratio of 10:1 and initially cured at 75ºC for ≈5min. The alginate sheet was slowly placed on the top of the PDMS, with the textured surface facing down and slightly pressed. The PDMS was left at room temperature for the final curing during ≈24h. When cured, the alginate sheet was taken off and PDMS samples were cut in a dog-bone shape (Figure 1b). Using a uniaxial tensile machine, the PDMS samples were tested to failure at 20 mm/min with an initial preload of 0.20N. The force-displacement data was recorded, and the stress-strain data was calculated.

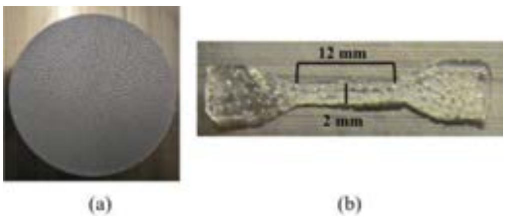


*Figure 1: (a) PLA stamp; (b) PDMS sample*

## Results

For this study, 3 samples were tested, and the average results are presented. The final thickness was 1.05±0.16 mm, which is within the range found in literature [5]. In the final stress vs. strain curve (Figure 2), the stress was calculated at different strain percentages (33%, 66% and 133%) in order to compare with previous work [5].

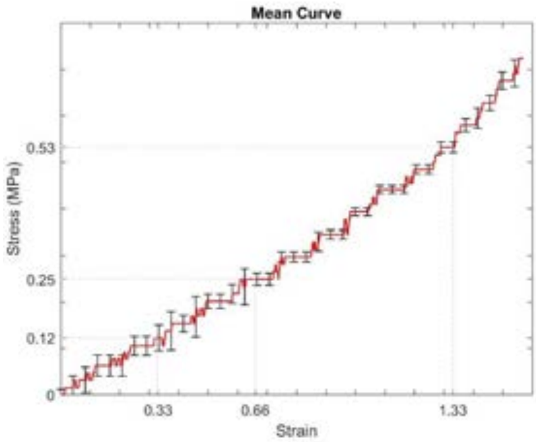


*Figure 2: Mean curve for the new texture, indicating the stress at 33%, 66% and 133% strain.*

## Discussion

Comparing with literature [5], the stress values obtained in this work are significantly lower, a possible indicator that the proposed texture contributes to a weaker structure, leading to a quicker rupture. Comparing to PIP implants, this approach does not improve the mechanical properties. A design with smaller pores with a homogeneous distribution might provide better results regarding the mechanical properties. Therefore, for future work, the testing of alternative textures along with imaging analysis and cell interaction is required.

## References

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