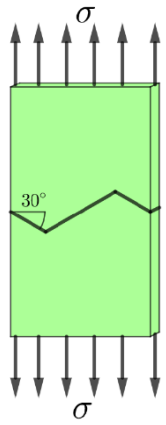
Silicone membrane bounding

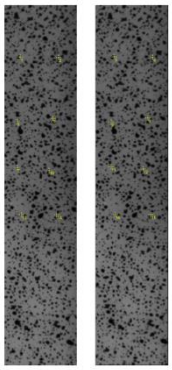
Cutting and reassembling silicone membranes can be problematic if the adhesive does not adhere.

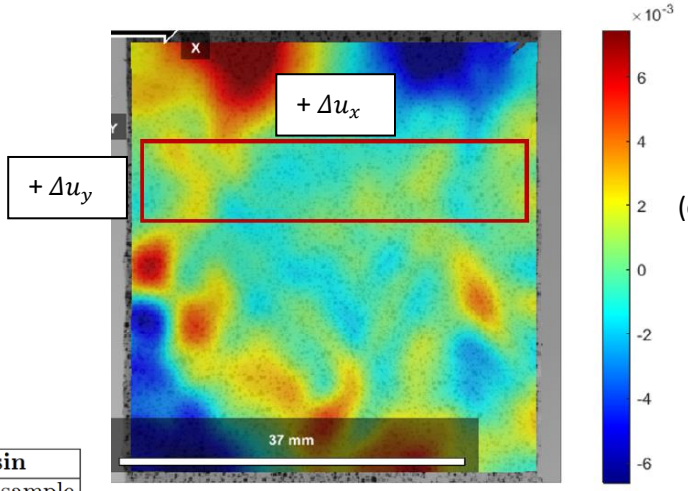
It turns out that Epoxy or Superglue does not adhere to surfaces like silicone type:

(a)



(b)





(c)

(d)

	Green resin	Pink resin
Used for	Mould the sample	Glue the sample
Commercial name	Elite double 32	Elite double 8
Chemical name	Vinylpolysiloxane	
Hardness	32 Shore A	8 Shore A
Young Modulus	1.1 MPa	0.25 MPa
Poisson ratio	0.49	0.49
Failure load	2.5 MPa	2 MPa
Density	1200 kg/m^3	

(e)

Type of glue	Characteristics	Glue behavior
UHU Super Glue	Superglue $\rho = 1{,}07$g/cm^3	Disconnection as soon as the sample is handled.
Araldite Standard	Epoxy adhesive $\rho = 1{,}15$g/cm^3	Disconnection as soon as the sample is handled.
Elite Double 32	Resin 32 Shore $\rho = 1{,}2$g/cm^3	Impossible to create sample rupture.
Elite Double 8	Resin 8 Shore $\rho = 1{,}2$g/cm^3	Good strength and the rupture can be observed.

In order to bond the membranes in (a) in such a way that breakage does not easily occur, it is possible to bond the silicone pieces in question with silicone of the same type. As (b), an ideal region of the sample must be chosen: it is shown in (c) in the Ncorr software, shifted horizontally. The silicon properties (d) and some experimental feedback (e) are listed above. Since silicone is an isotropic material, the use of the same matter as a glue does not affect the Young's modulus. The use of a less resistant silicone modifies the behavior of a sample, hence the interest in determining the effective Young's modulus in the presence of the two types of silicones.

To determine the Young modulus of the sample, we treat the problem with segments:

1. Determine the strain component of each segment according to x and y coordinates: a red square is defined in Ncorr. L_i is the length of the x and y component of the red square. Δu_i is the elongation of each axis component. The strain according to x and y is given by:

$$\epsilon_x = \frac{\Delta U_X}{L_x} \qquad \epsilon_y = \frac{\Delta U_Y}{L_y}$$

2. By definition, the Poisson ratio is the relationship between ε_x and ε_y. The process to find the Young modulus of the sample is to average over all the segments the results found for one of them, with ΔF the force difference before and after elongation.

$$E = \frac{\Delta F}{A\epsilon_x} \quad \nu = \frac{\epsilon_y}{\epsilon_x}$$