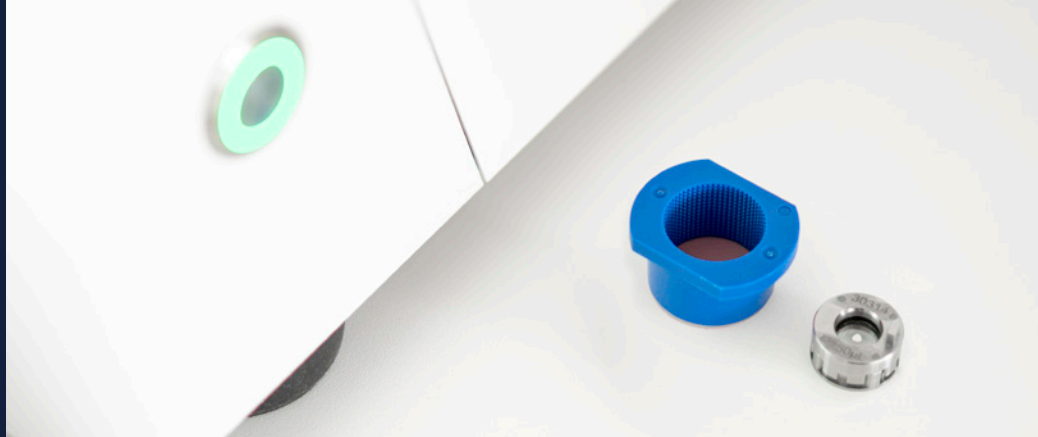
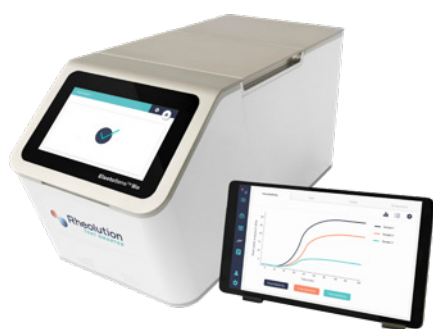




Technical note | ElastoSens™ Bio

How do the μ -volume and the macro-volume sample holders of the ElastoSens™ Bio compare?



ELASTOSENS™ BIO

μ -VOLUME VERSUS MACRO-VOLUME SAMPLE HOLDER

The μ -volume sample holder was developed as an alternative to the macro-volume sample holder for projects where sample volume is restricted. Due to the non destructive nature of the technology, the sample can be kept in both sample holders and retested multiple times to follow the mechanical profile over time of the sample in controlled environments. One important difference is that the μ -volume sample holder was designed to fit in a 12-well plate for easy sample incubation, and completely autoclavable (made of stainless steel) to better maintain sample sterility.

Similarly to the macro-volume sample holder, soft synthetic polymers, natural polymers, blood and plasma, cellularized hydrogels, native tissues, among others, can be tested in the μ -volume sample holder. As long as the operation guidelines of the ElastoSens™ Bio are followed and the sample requirements are met (**Table 1** and previous publication for reference), the viscoelastic properties given by both holders should be similar. However, there are two important notes to highlight after this statement:



**TIME
MEASUREMENTS**



**THERMO
STIMULATION**



**TESTING
CONFIGURATION**



**ATMOSPHERIC
CONTROL**

- 1) The μ -volume sample holder does not contain the bottom membrane that holds the liquid sample at the beginning of the test like the macro-volume sample holder. Therefore, only solid samples can be tested in the μ -volume sample holder. This means that the crosslinking kinetics may just be captured after the liquid-gel transition point, when possible. If not, the final stiffness (G' at the plateau region of the S-curve) can be obtained with both holders.
- 2) The difference in sample volume and sample exposure to the external environment of each sample holder can affect the results depending on the material tested. For example, thermosensitive materials will answer faster to temperature changes when a lower volume of sample is exposed to thermal stimulation. When the external stimulus is light, its penetration on photosensitive polymers loaded into both holders may be different due to the differences in dimensions. Polymers with high water content are susceptible to drying which has a greater effect on smaller samples. The examples are not limited to these three, and a more detailed investigation should be carried out by the user to analyze the effect of volume and exposure to the external environment (and stimuli) on the viscoelastic properties of the sample.

COMPARING RESULTS OBTAINED USING THE M-VOLUME AND THE MACRO-VOLUME SAMPLE HOLDERS OF THE ELASTOSENS™ BIO.

In order to validate the similarity of the results obtained with both holders, a silicone rubber was selected to be loaded and tested in the ElastoSens™ Bio. The level of stiffness of this polymer allows the use of small volumes in the macro-volume sample holder which minimizes the potential variation caused by this parameter (volume effect on polymerization and viscoelastic properties). In addition, this synthetic polymer is chemically crosslinked once it is mixed with the curing agent reducing the need of an external stimuli to provoke crosslinking or gel formation.

The mixture of polymer and the curing agent (PlatSil® 71-11, Polytek® Development Corp., USA) was done following the ratio of 10:1 and immediately poured in the macro-volume sample holder (0.9 g) and in the μ -volume sample holder (250 μ L, following methodology 2). Samples were left at room temperature for 35 min and transferred to the ElastoSens™ Bio. The tests were carried out for 9 minutes using a temporal step of 10 s at 37 °C. Average results are expressed as mean $\pm$ standard deviation (n=3). Statistical analysis was performed using the ordinary one-way ANOVA (GraphPad Prism Software, USA). Significance was retained when $p < 0.05$.

Figure 1 shows the shear storage modulus (G' , Pa) obtained from each sample holder at different degrees of crosslinking (after 30 s, 60 s, 90 s, 120 s, 150 s and 180 s at 37°C). No statistical differences were found between the results obtained with the μ -volume and the macro-volume sample holder within the same degree of crosslinking.

Table 1: Dimensions and sample requirements for the μ -volume and the macro-volume sample holders of the ElastoSens™ Bio.

				Sample requirements		
	Diameter (mm)	Height (mm)	Volume (mL)	Diameter (mm)	Height (mm)	Volume (mL)
Macro-volume sample holder	23.1	19.0	Up to 7.0	23.1	Up to 19.0	Up to 7.0
μ -volume sample holder	14	1.6	0.25	14.0	1.6	0.25

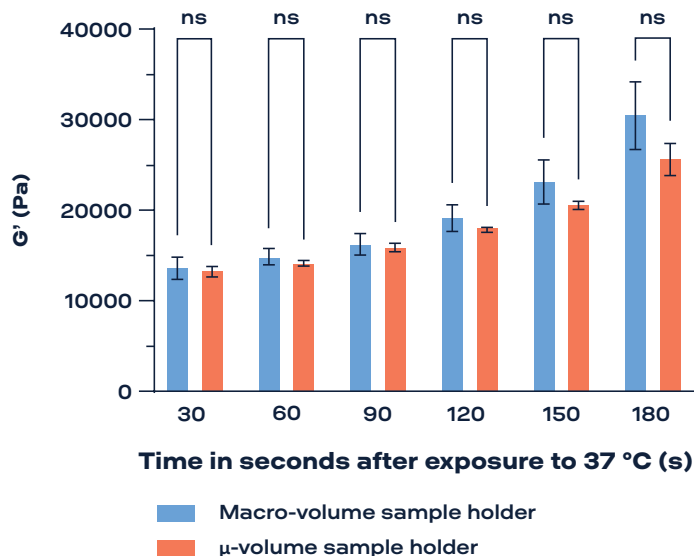


Figure 1: Shear storage modulus (G' , Pa) versus degree of crosslinking for silicone rubber measured with the ElastoSens™ Bio using the μ -volume (orange) and macro-volume (blue) sample holders.

KEY TAKEAWAYS

- The μ -volume sample holder of the ElastoSens™ Bio was designed to be completely autoclavable and to fit in a 12-well plate for easy sample storage
- The user needs to conduct a thorough investigation when comparing the viscoelastic properties obtained using the μ -volume and the micro-volume sample holder due to the possible effect of sample volume and different exposure to the external environment.
- When the effect of sample volume and the different exposure to the external environment are negligible, the viscoelastic properties obtained using the μ -volume and the macro-volume sample holder should be comparable.