

Tensile Testing of Contact Lenses | In a Temperature-Controlled Bath

Millions of people use contact lenses on a daily basis, making them one of the most widely used medical devices in the world. Preferred over eyeglasses, they are used for a variety of eye correction prescription and are manufactured in an array of forms ranging from hard to soft lenses.

When testing lenses, loading the specimen into the grips can pose many problems: the soft lens material is slippery and delicate fractures at very low forces; and the test specimens are extremely small, providing a limited amount of gripping surface. Contact lenses must also be tested in an environment that best simulates physiological conditions; ambient testing results in the drying out and cracking of the material.

Test Configuration and Sample Preparation

A 5544 electromechanical test frame configured with a 10 N load cell and 250 N submersible pneumatic grips with extra long surfalloy faces were used for this test. The Instron® BioPuls™ Submersible Pneumatic Grips and Temperature-controlled Bath was used to keep the contact lenses hydrated and at body temperature. The specimens were cut into strips in order to obtain accurate data for measuring strength and tensile strain. A test speed of 5 mm/min was used. The complete test configuration is shown in Figure 1.

The most common method for characterizing contact lenses is a basic tensile test to failure. Bluehill® 2 software was used to evaluate maximum load, tensile strain at the maximum load and the modulus for two contact lens specimens.

Results

These results show that the test configuration was successful in testing the contact lenses and was able to accurately demonstrate the low forces required to measure specimen failure. The data was fairly consistent and is shown in Figure 2 and Table 1.



Figure 1:
Test configuration for contact lens tensile test using BioPuls submersible pneumatic grips and temperature-controlled bath.

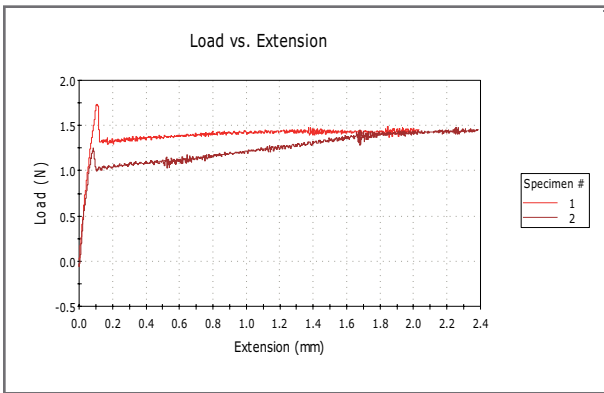


Figure 2:
Load vs. Extension results for two contact lens specimens.

	Max Load	Modulus
	N	MPa
1	1.736	0.231
2	1.481	0.419
Mean	1.608	0.325
S.D.	0.180	0.133

Table 1:
Results for two contact lens specimens during tensile testing.

Conclusions and Recommendations

In conclusion, contact lenses can easily be tested using the previously described configuration. It is recommended that the faces used for this testing allow for zero grip separation in order to accommodate for the small overall length of the contact lens specimen.

Configuration Table

Catalog Number	Configuration Options	Description
5544	Frame	Single column test frame
2530-428	Load Cell	10 N Capacity
2752-005	Grips	250 N BioPuls™ Submersible Pneumatic Grips
2702-207	Faces	Extra long surfalloy
3130-100	Bath	BioPuls temperature-controlled bath
2410-270U1	Software	Bluehill® 2 software with tension application