INSTRON
The difference is measurable®
TechNotes
Getting the most up-to-date information on materials testing
Instron.com | Subscriptions | Newsletter Archive | Testing Solutions | Contact Us
Issue 50

In This Issue

Project 2.6g 329m/s

For this 50th edition of TechNotes, it's been fascinating to look back over some of the previous articles covering the development and testing of new materials and new applications for materials. Some of the most popular articles judging from your feedback have been those that have looked at the ongoing efforts to develop synthetic spider silk and the efforts to manufacture effective lightweight body armor. Recently, an amalgamation between art and science has resulted in the development of what many newspapers and popular science publications have trumpeted as bulletproof human skin.

Bulletproof skin. The words conjure up images of bullets bouncing off the superhero's chest as the villain opens his eyes wide in amazement. The recent flurry of hyperbolic headlines in newspapers, the web, and popular science magazines announcing the arrival of bulletproof human skin made it seem as if that possibility was already here. "Scientists to Engineer a Human with Bulletproof Skin" proclaimed the International Business Times on August 23, 2011. The reality is rather more mundane although it still offers exciting possibilities. The Designers & Artists 4 Genomics Award, DA4GA, a competition launched by the Waag Society in Amsterdam, Holland, invited emerging artists and designers to submit projects exploring biotechnology. One of the winning projects, named 2.6g 329m/s, is a manufactured human skin that has properties that make it very strong and resistant to penetration. The name comes from the performance standard for Type 1 bulletproof vests. 2.6g 329m/s is the maximum weight and velocity of a traveling bullet from which a Type 1 bulletproof vest should protect you.

The project artist, Jalila Essaidi, worked with the Forensic Genomics Consortium Netherlands to develop human skin with a layer of transgenic spider-silk sandwiched between the epidermal and dermal layers. The silk is a product of research done by Utah State University researcher Dr. Randy Lewis. It is produced from goats and silkworms that have been genetically modified to produce the two proteins necessary to make spider silk. The silk is harvested from the animals and woven, using special bulletproof vest techniques, into a scaffold upon which is cultured human skin cells.

The team manufactured skin samples using two types of silk: one from unmodified silkworms and one from the transgenic silk. Essaidi mounted the skins on gelatin blocks and, using a high-speed camera, filmed bullets fired at the skins. A bullet fired at a reduced speed pierced the skin woven with an ordinary worm's silk. When tested with skin manufactured from Lewis' genetically engineered silk, the skin didn't break. However, neither skin was able to repel a bullet fired at normal speed from a .22 caliber rifle. Furthermore, the bullet that did not penetrate the skin still travelled 5 cm into the gelatin block.

Lewis was happy to collaborate in the project, viewing it as a way to widely demonstrate the properties and capabilities of the transgenic silk. However, he downplays the potential bulletproof applications of his research. In a recent interview on CNN, he said that this was an interesting experiment but he didn't see it as the future for mankind. His interest lies more in the possibility that growing human skin cells on the silk may eventually enable doctors to use the material to replace large amounts of human skin and cover large wounds or treat people with severe burns. The material's strength and elasticity would enable doctors to cover large areas without worrying about it ripping out — a big advantage over small skin grafts. He says it may be possible to use the genetically engineered silk as a framework for growing ligaments or tendons with better mechanical properties than those provided by nature.

So while the long sought-after "warrior gene" may still live in the domain of comic books, the ongoing research into biosynthetic material engineering comes closer to offering major medical benefits to the human race.

Keep It Consistent

Consistency is the key to accurate and repeatable test results. Variations in the test setup, test procedure, environmental conditions, and operator input can all affect the test results.

- Make sure that the appropriate gauge length, test speed, type and capacity of load cell, and grip and grip jaw selection are appropriate.
- Insert the specimen in the grips correctly and clamp it securely. Manual wedge grips are difficult to tighten consistently even with the same operator. You can minimize this variation by using pneumatic grips that always grip at the same pressure.
- Control the temperature and humidity to standard laboratory conditions or record the actual conditions when a test is performed.
- Ensure that your testing system and accessories are regularly serviced and calibrated to keep them at the peak of efficiency.

Q. What is a durometer? Is it an instrument or a measurement?

A. It's both. A durometer is an instrument used to measure hardness and is typically used on polymeric, elastomeric, and rubber materials. Durometer also refers to the hardness result obtained.

There are several scales of durometer, used for materials with different properties. The most common scales are the ASTM D2240 type A and type D scales. The A scale is for softer materials, while the D scale is for harder ones. However, the ASTM D2240-00 testing standard details 12 scales, depending on the material to be tested; types A, B, C, D, DO, E, M, O, OO, OOO, OOO-S, and R. Each scale results in a value between 0 and 100, with higher values indicating a harder material.

Durometer is a dimensionless quantity that offers a comparative value within any particular scale. There is no simple relationship between a material's durometer in one scale, and its durometer in any other scale.

Instron Worldwide Headquarters
825 University Ave
Norwood, MA 02062
www.instron.com