Analytical Instrumentation, Methods & Materials

Testing the Strength of Soft Materials

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The Wisconsin Alumni Research Foundation is seeking commercial partners interested in developing a method to assess the failure properties of soft materials. The technique uses acoustic emissions to create a high-throughput, minimally invasive way to test materials in real time.

Overview

Soft materials are everywhere. In many applications, valuable information about the strength of these materials enables more precise control in everything from cutting and processing soft foods to designing new medical devices or assessing tissue properties for diagnostic applications. Current testing methods, such as 3- or 4-point bending, puncture/indentation and wire cutting, require lots of material and are destructive. An efficient, minimally invasive technique that works in real time is needed.

In hard materials like ceramics, concrete and composites, acoustic emissions (AE) testing detects the release of elastic energy in fractured materials and provides qualitative and quantitative data on crack nucleation, crack propagation, plastic deformation and dislocation motion. It has been used in applications like seismic and structural health monitoring. AE testing has yet to be widely studied in soft materials.

The Invention

UW-Madison researchers have developed a method for testing the mechanical and failure properties of soft materials using a non-contact, portable vibrometer that measures acoustic emissions. The team has established a direct link between the characteristics of emissions from failure in the materials and their properties. AE signals include maximum amplitude, frequency content, duration, rise time and energy. Vibrometers can measure the AE of incredibly small fractures – on the order of several micrometers – at multiple locations with high frequency, making them ideal for monitoring soft materials in real time.

Applications

- Measures and monitors the strength and durability of soft materials

Key Benefits

- No comparable method is currently available on the market
- Provides comprehensive data on the failure threshold and load-bearing capacity of soft materials in real time
- Can continuously monitor multiple, microscopic fractures at high speeds (~100 kHz)
- Non-contact measurements of acoustic waves allow for affordable, minimally invasive, high throughput monitoring

Stage of Development

The team tested their method using gelatin-based hydrogels with different concentrations. They introduced fractures of various sizes into the gels using different degrees of force. The AE from these fractures were measured using a non-contact laser vibrometer. Similar to hard materials, the energy of AE in soft materials was found to increase as fracture energy increased. From these data, they computed the failure properties of the materials.

Additional Information

For More Information About the Inventors

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Tech Fields

- Analytical Instrumentation, Methods & Materials : Lasers
- Analytical Instrumentation, Methods & Materials : Sensors

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867