Apparatuses for Pre-Stressing Specimens in Tension for In Situ Fracture Testing in a High Pressure Hydrogen Environments

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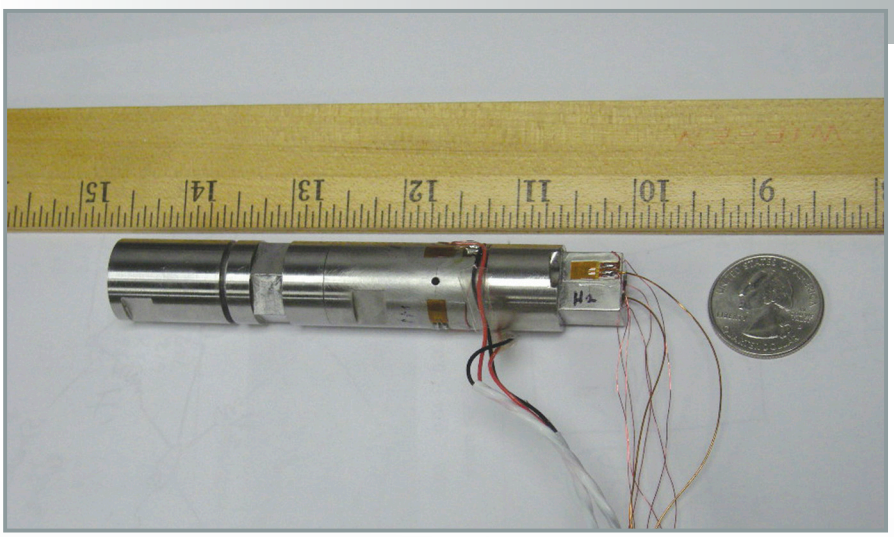

Technology Summary

ORNL researchers developed devices for providing a specific amount of stress to a rod-shaped sample material. Once the desired stress range is applied to the sample, the entire assembly may be introduced into a high-pressure environmental chamber for analysis. The device is small enough that several different samples may be placed within the same environmental chamber for simultaneous testing.

The invention addresses the challenge of determining the influence of high pressure gases (e.g., hydrogen) on materials and especially on weld zones. This information is important for energy development and transportation projects. Conventional methods of measuring cracking behavior are typically not suited or cost effective in high pressure environments. They also show scatter and inconsistencies around the weld zone, even within the same family of materials.

In contrast, this invention is particularly suited for testing materials in high pressure hydrogen environments. In one version of the device, a strain gage is applied to the specimen. Each specimen can be individually calibrated to determine the stress-strain created by a known force. Potential applications for these devices include hydrogen-carrying pipe materials for nuclear power plant applications and hydrogen fuel cell materials for the transportation industry.

Advantages

- Small size
- Simplicity of design
- Low cost of manufacture and ownership
- Facilitates in situ testing in cramped environments

Potential Applications

- Fracture testing for materials used in transportation, nuclear-power–generated hydrogen, coal-gasification-based hydrogen

Patent

Jy-An Wang, Ken Liu, and Zhili Feng, *Apparatuses for Pre-stressing Rod-type Specimens in Tension for In Situ Passive Fracture Testing in an Extremely High-Pressure Environment of Hydrogen,* U.S. Patent Application 12/498,877, filed July 7, 2009.

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