

CSIRO Hollow Inclusion Stress Cell

Features



- Triaxial stress measurement in rock or concrete
- Recommended by the ISRM for stress determination
- Designed for monitoring during overcoring applications
- Short or long term monitoring of triaxial stress
- Complete 3D stress tensor from one measurement
- Fully encapsulated electronics
- Range of grouts for specific application temperatures

Applications

The CSIRO HI Cell is a proven, reliable and accurate instrument to determine triaxial stress in rock or concrete.

Common applications of HI Cells are for monitoring stress changes over time or determining orientation and magnitude of virgin stress by method of overcoring.

HI Cells are installed in metalliferous mines, coal mines, dams, tunnels, bridges, underground caverns, storage facilities and other civil engineering projects.



Technical Specifications

Stress Range	Up to 100 MPa	Accuracy	Standard error of stress +/- 10 ppm
Temperature Range	5° to 50° C	Strain Gauges	Gauge length 10mm
Gauge Resistance	120 Ohms	Gauge Factor	2.07 to 2.11 (varies with cable length)
Circuit Configuration	Three wire, quarter bridge	Borehole Size	38 mm diameter (EX or EXT) for HI Cell 100–150 mm diameter for overcore

Operating Principle

The HI Cell consists of an array of strain gauges that are encapsulated in the wall of a hollow pipe with known Elastic Modulus. The cell is epoxy grouted into a borehole and monitored for strain response during overcoring or left permanently installed for measuring relative stress over time.

The HI Cell is installed into a 38mm hole by filling the hollow body of the cell with a pre-formulated epoxy cement. Cement is extruded by the piston when the cell reaches target depth. Pushing the body of the cell, via installation rods activates the piston and a trip wire within the cell registers completion of extrusion.

Multiple rubber seals confine the grout flow to around the cell. Prior to installation, the hole is cleaned with compressed air and the walls of the hole prepared for the HI Cell. Once the grout has cured, the strain gauges are fully bonded 1.5 to 2.0 mm from the borehole wall, for which allowance is made during data reduction. Monitoring of the strain response is possible during overcoring via the data cable, which runs through the drilling rods and a modified water swivel to a strain indicator. The ability to record strain gauge information during overcoring provides valuable information, and indicates conditions such as the onset of core cracking, cell de-bonding or inelastic response of the rock. The retrieved overcored section of rock containing the cell may be restressed in a biaxial pressure chamber to derive the actual rock properties of Young's Modulus and Poisson's Ratio.

Long term stress change monitoring is possible with the HI Cell and is best suited to monitoring compressive or tensile stress changes in the long term.

The standard HI Cell has twelve strain gauges and is suitable for measuring both isotropic and anisotropic rock.

An optional temperature measuring thermistor is available to provide a check of possible temperature changes at the HI Cell site.

Environmental Systems & Services Pty Ltd.

8 River Street, Richmond, VIC, 3121 Australia

PO Box 939, Hawthorn, VIC, 3122 Australia

Telephone: + 61 3 8420 8999

Facsimile: + 61 3 8420 8900

Email: geotechnical@esands.com

Web: www.esands.com