SUPERCRITICAL WATER TEST FACILITY

(Feasibility Study of Supercritical Light Water Cooled Fast Reactors for Actinide Burning and Electric Power Production)

Yongsun Yi, Sebastien Teysseyre, Brian Krieger, Joshua McKinley, and Gary Was

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The University of Michigan

MichiganEngineering

OBJECTIVE

This Test Facility will be used

for SCC (Stress Corrosion Cracking) Tests

in a Supercritical Water Environment

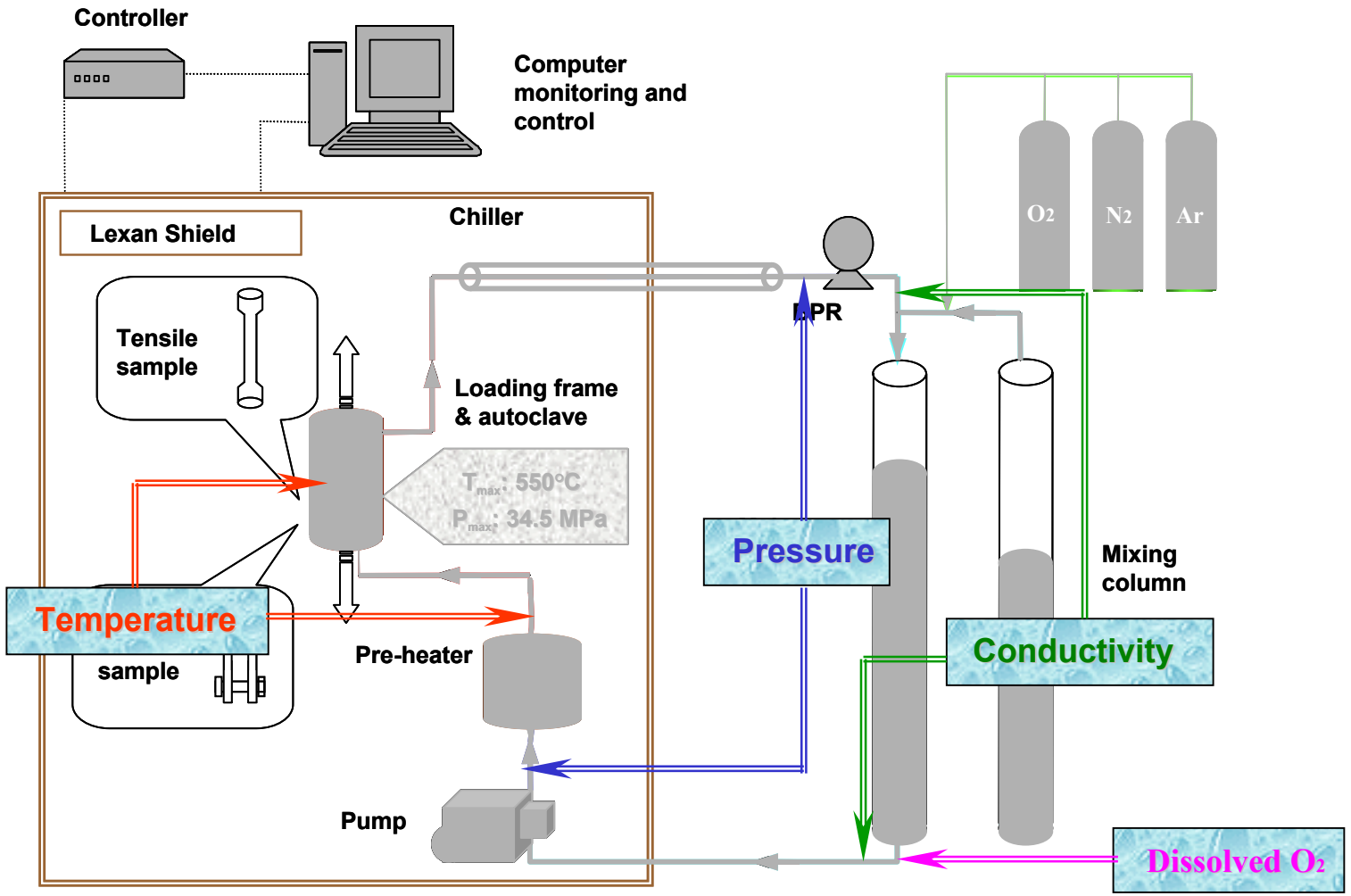
using

- Tensile Sample
- U-bend Sample

DESCRIPTION

- **Supercritical water loop** system
- A **tensile** sample (irradiated or unirradiated) and six **U-bend** samples can be loaded.
- **Various loading** modes can be applied.
- **Environmental parameters** are controlled and monitored.

Schematic of SCW system



Pho

Test Vessel

Sample

Vessel internals

Columns

Mixing column

Main water column

Pre-heater and Main pump

Pre-heater

Main pump

Controller

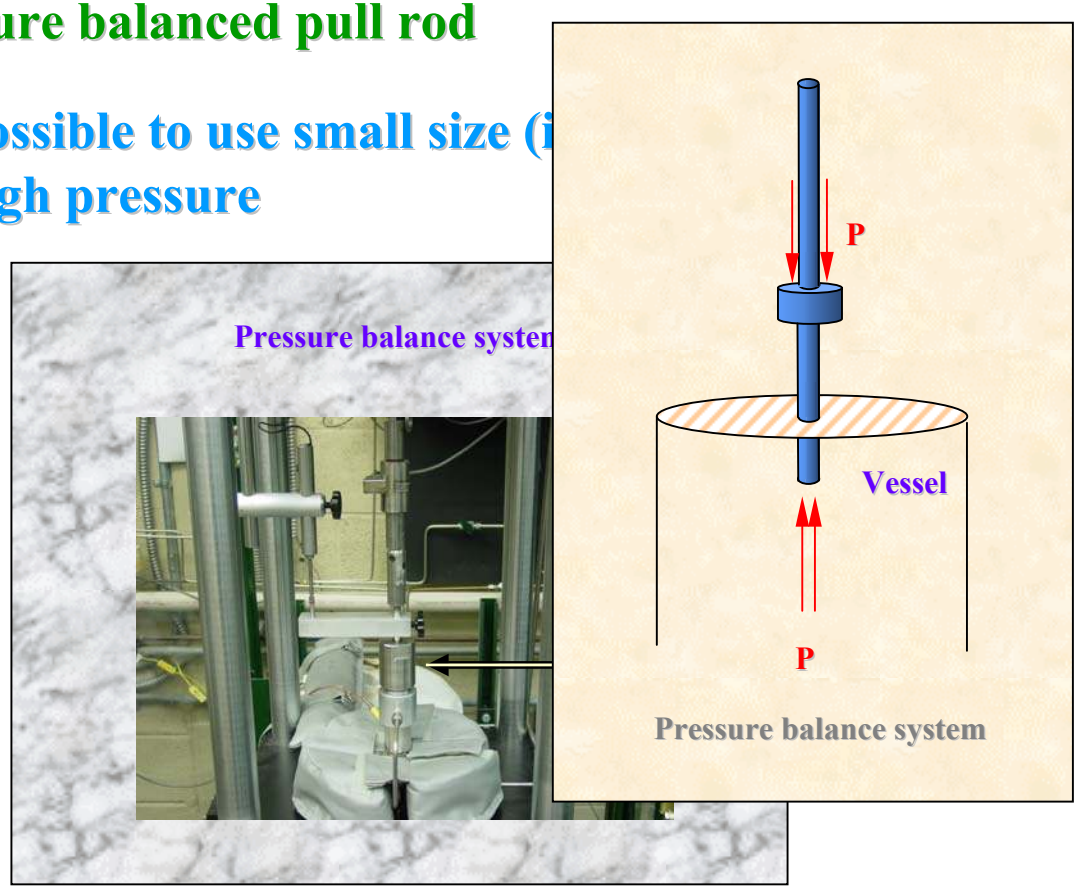
Pump

P

O2

Pressure balance system (one unique feature)

- **Self pressure balanced pull rod**
  - **Possible to use small size (i**
    high pressure



System Capability

1. Environmental conditions

- **Temperature and Pressure**

  : maximum 550°C at 34.5 MPa

- **Conductivity**

  : Lower than 0.1 ㎲/cm

- **Dissolved oxygen**

  : Below 10 ppb - above 20 ppm

- **Flow rate**

  : Up to 100 ml/min

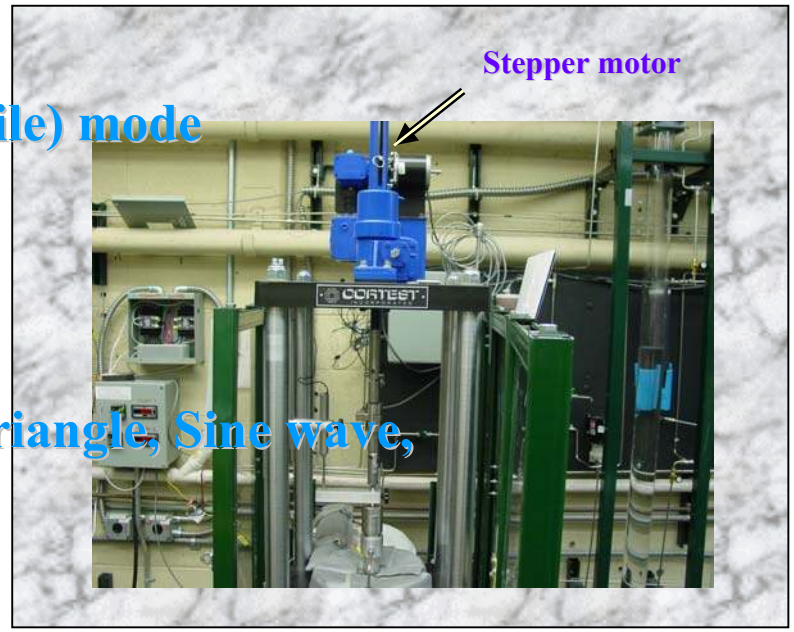
System Capability

2. Mechanical Condition

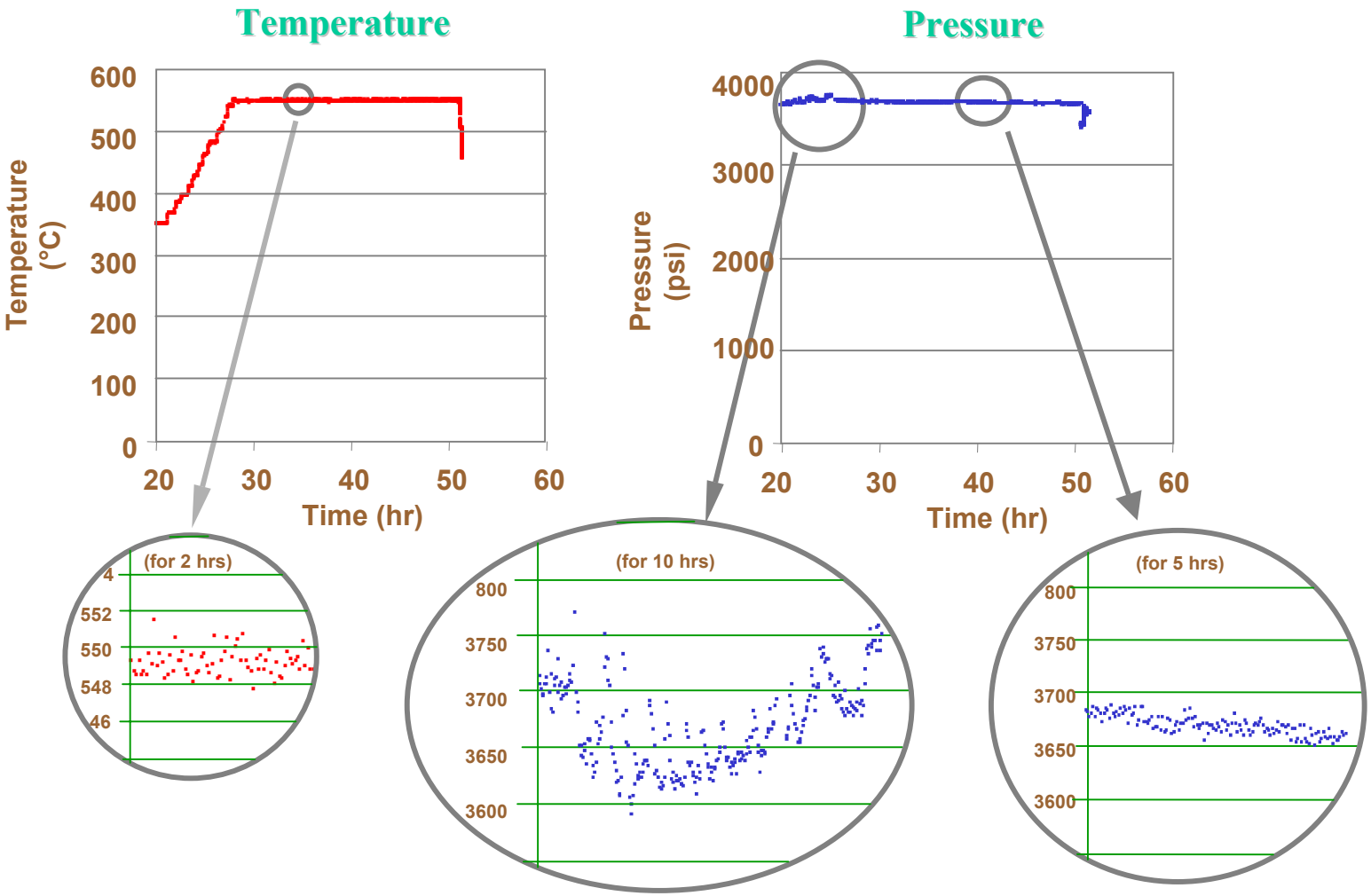
- **Various loading mode**

  by stepper motor and motion controller

  - **CERT (Constant extension rate tensile) mode**
  - **CLT (Constant load tensile) mode**
  - **Step loading mode**
  - **Fatigue loading mode (Triangle, Sine wave, trapezoidal wave)**
  - **Mixed loading mode**

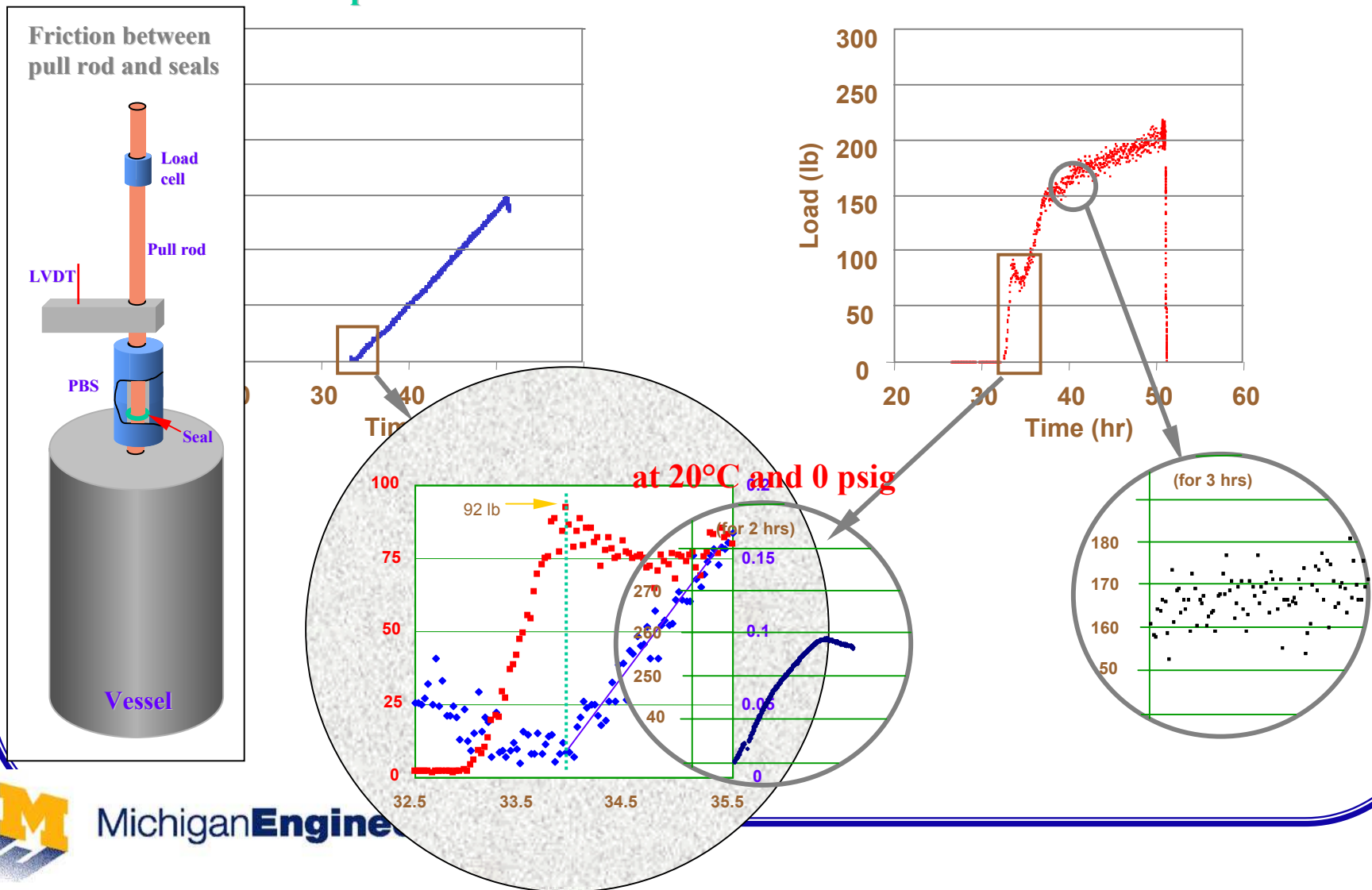


Performance Test



Performance Test

at supercritical condition (550°C and 3700 psi)



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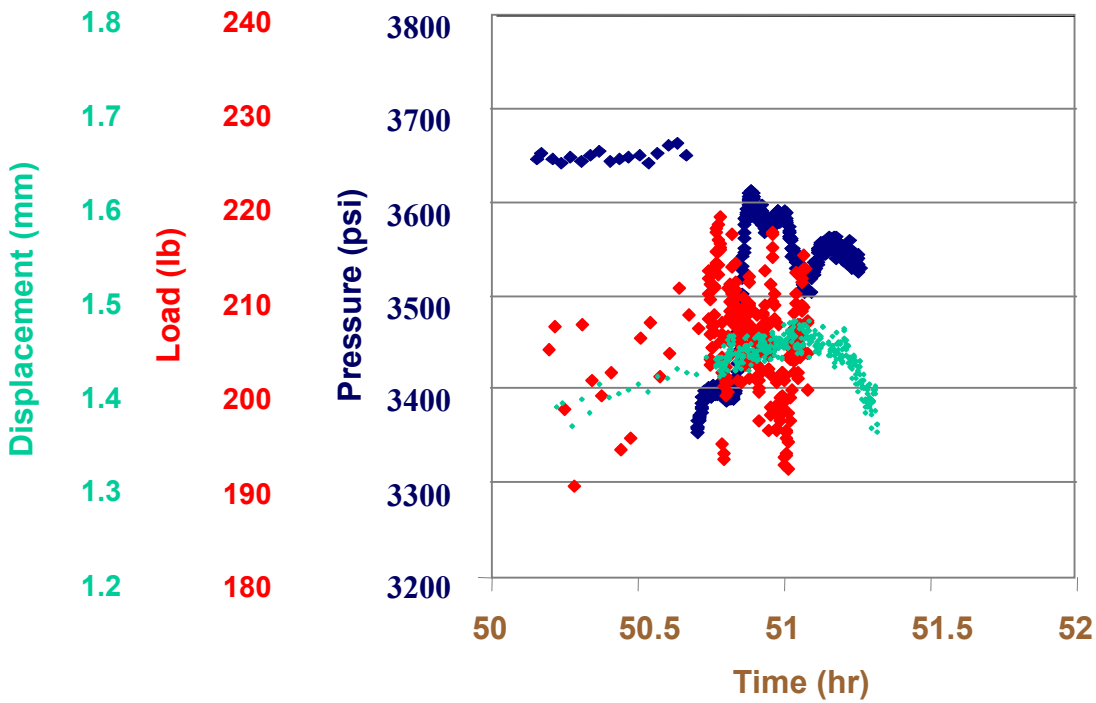
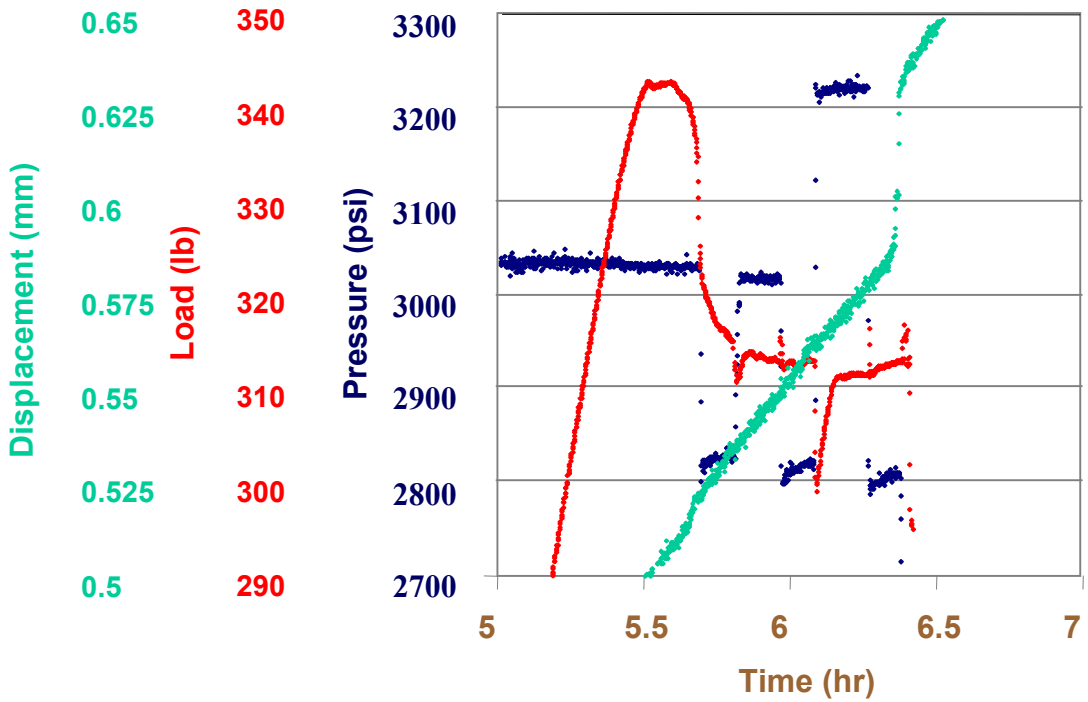
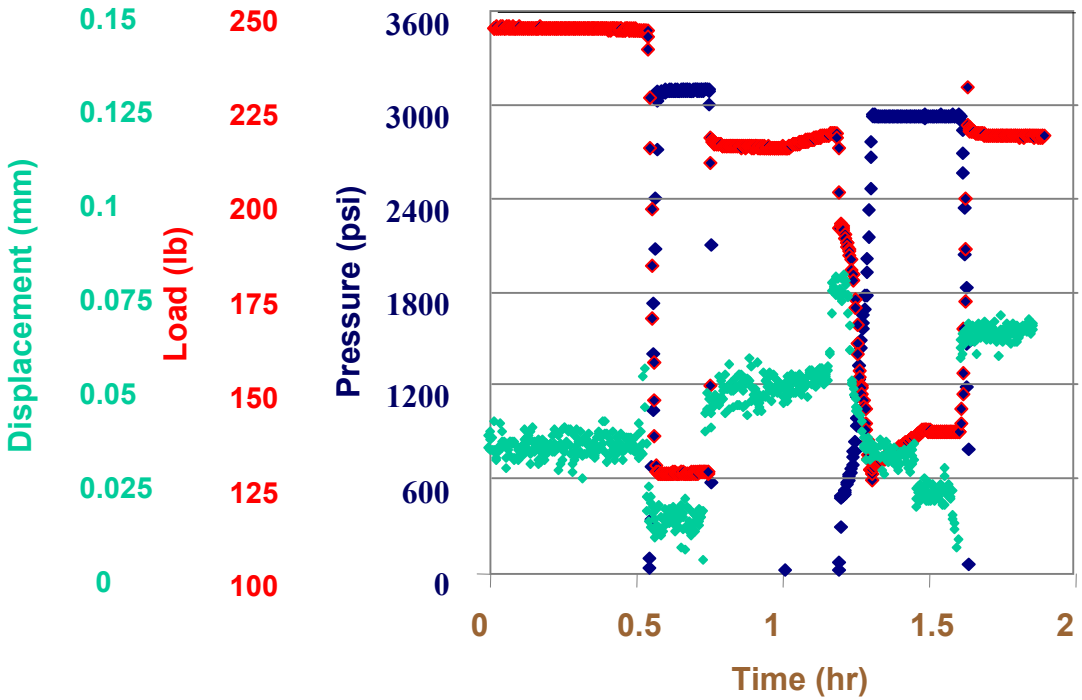
Pressure change
at supercritical water condition

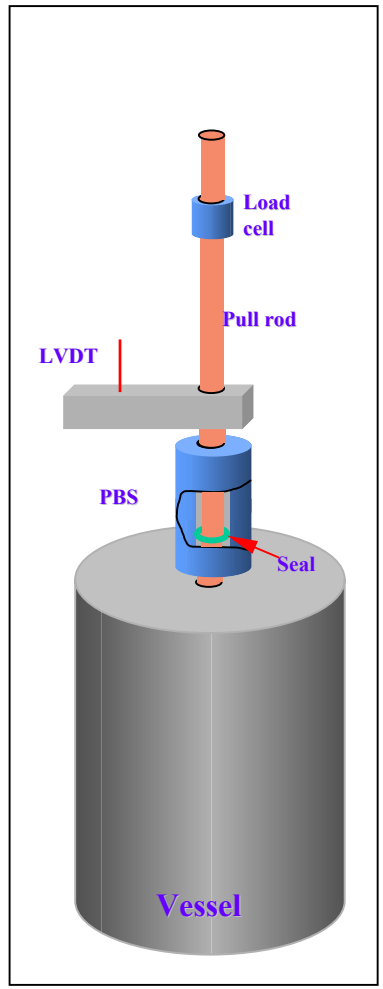


Small pressure (200 & 400 psi) change at room temperature

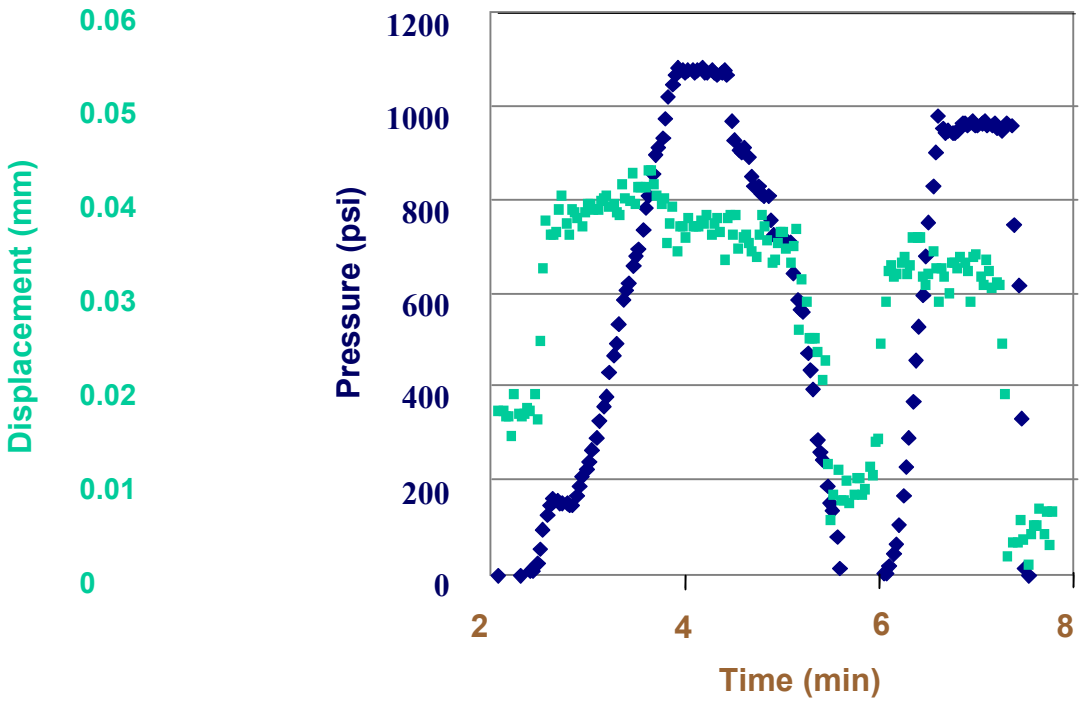


Large pressure (3000 psi) change at room temperature





Pressure change (1000psi) with load cell disconnected at room temperature



STATUS

Completed

- **Full fabrication of the system.**

- **Performance test**

  - Test temperature (550 C) and pressure (3700 psig) were achieved.

  - A dummy sample was strained at test conditions.

  - Correct measurements for load and strain were gathered and confirmed.

STATUS (continued)

In Progress…

- Develop method and software for adjusting measurements to true values of stress and strain.

  - Perform compliance test on the system.

  - Analyze the effects of pressure change quantitatively on stress and strain.

- Test control of water chemistry.