Second NMI3 General Assembly in Barcelona, Spain
Sample Environment section

High Pressure task: progress

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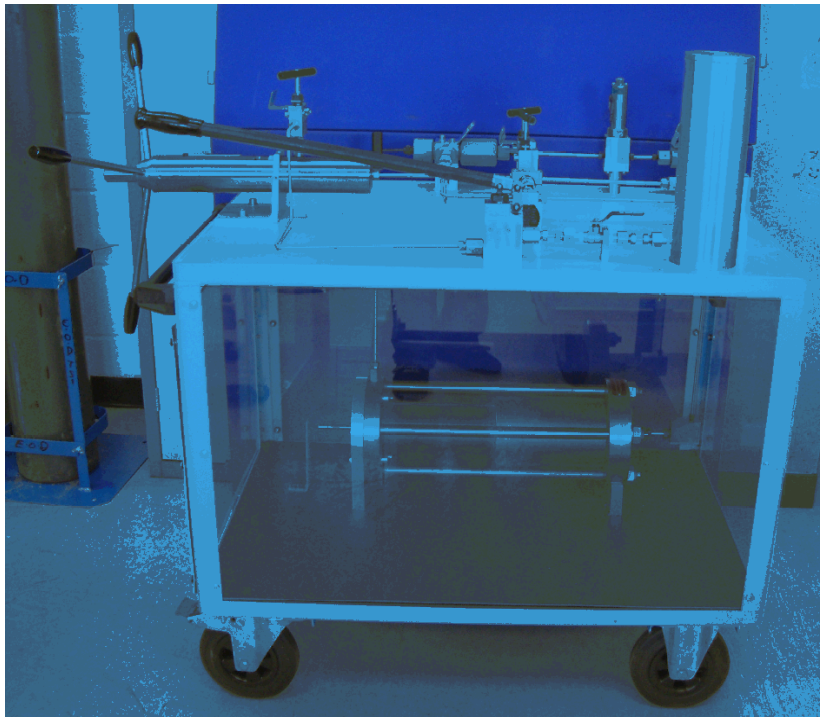
Oleg Kirichek, ISIS, STFC

1. Report on current inert gas pressure cell technology (D21.02)

- In the report we review a high pressure technique based on a gas medium compression.
- This technique covers the pressure range up to ~0.7GPa and typically uses compressed helium gas as the pressure medium.
- We are grateful to Jean-Michel Mignot and Burkhard Annighofer for their contribution and valuable discussions.

2. 13 - 15 kbar hydraulic intensifier for cell testing: assemble (D21.06)

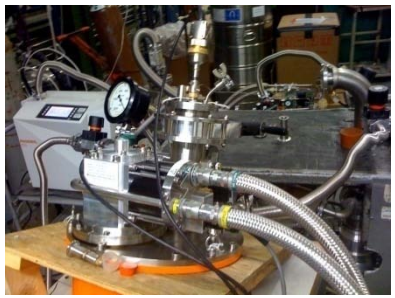
The 13.8 kbar oil intensifier system is planned to be used for high pressure cell testing. The assembled system has been successfully tested up to 13.8 kbar and now is fully operational.



3. 10 kbar automated gas handling system (M21.2.1.2)

The automated inert gas handling system is planned to be used for high pressure cell testing: operating from 0 to 10,000bar, transducer accuracy of 0.3% full scale and pressure changes in steps of 40 bar. This system is able to be controlled by instrument computer. The system has been assembled and successfully tested up to 10 kbar in fully automated regime by ***Hi-Pro Pressure Products Ltd***.

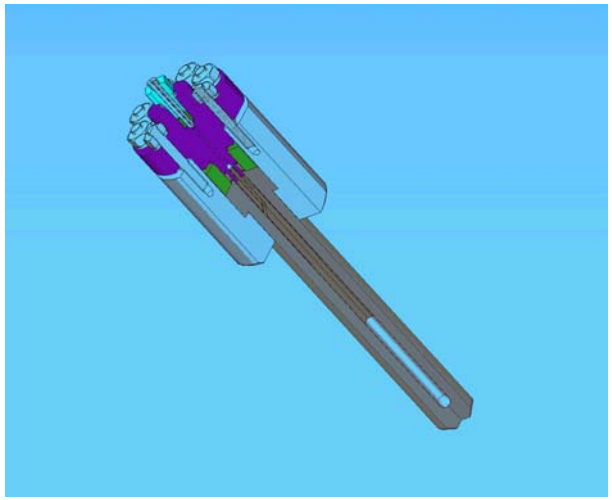
4. Procurement of LLB cryogenic system for pressure measurements (D21.07)



*Top-loading cryo-generator from **AS Scientific Products**. From left to right:*
(1)General view of the cryostat during the test of operation with 20° tilt.
(2)(top) Display; (bottom) head of the cryostat and hoses of the pressurized helium circuit.
(3)Water chiller and temperature controller.
(4)Back of the compressor unit and helium buffer.

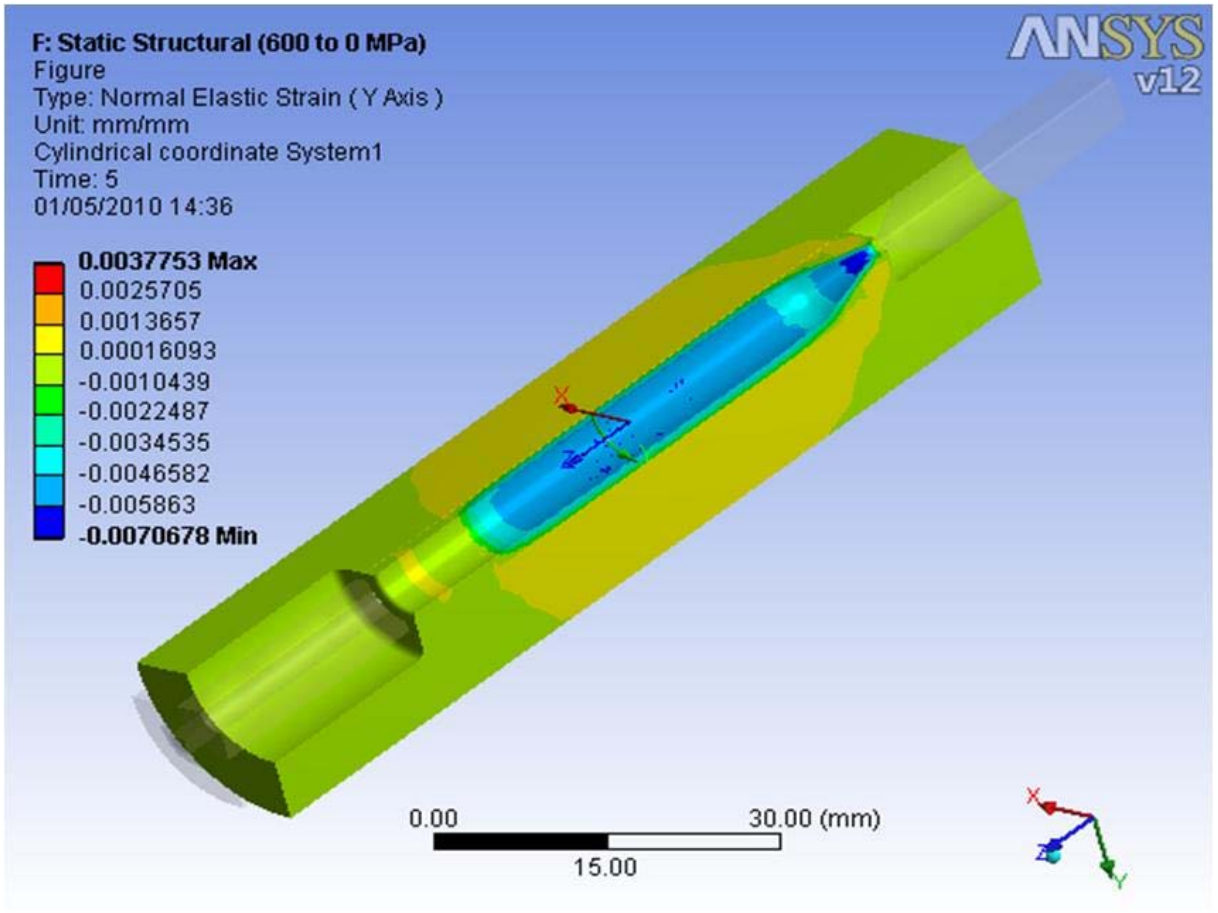
5. Manufacture and test prototype cell for 4 kbar hydrogen and up to 700K (D21.08)

The prototype of 4 kbar and up to 700K high pressure hydrogen gas cell has been designed, manufactured and tested at ISIS facility. The cell wall thickness has been optimized for a given cell material (**Inconel**), according to the neutron wavelengths of most interest.



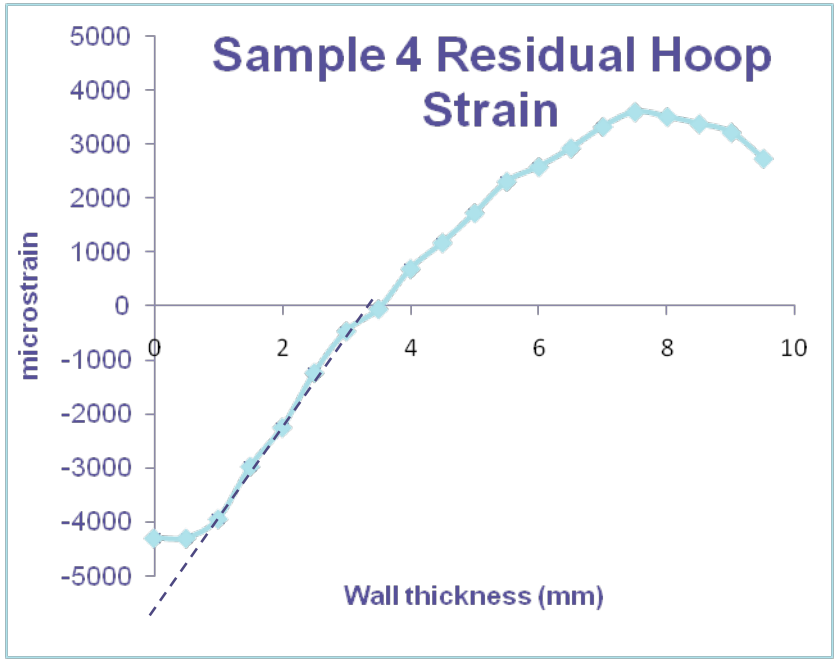
Following ISIS high pressure engineering practice the design pressure of the cell has been set up at **4.4 kbar** at **700K**.
After manufacturing and assembling, the cell has been successfully tested up to **5.835 kbar** of hydrogen gas pressure at **20°C,** which, according to engineering model, should satisfy design pressure requirements at **700K**.

Developing a prototype of 8 kbar inert gas cell.

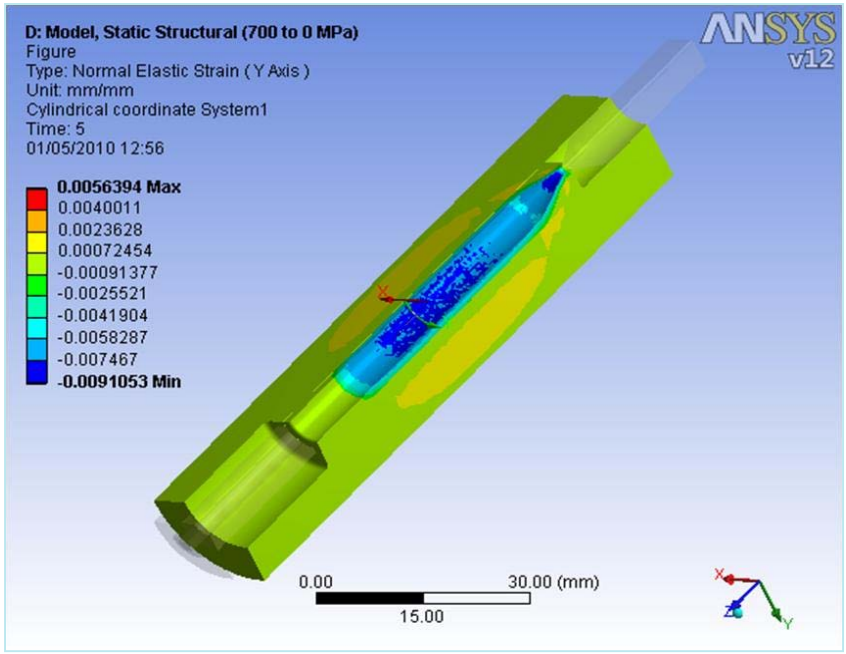


The FEA model (600 MPa)

Developing a prototype of 8 kbar inert gas cell.



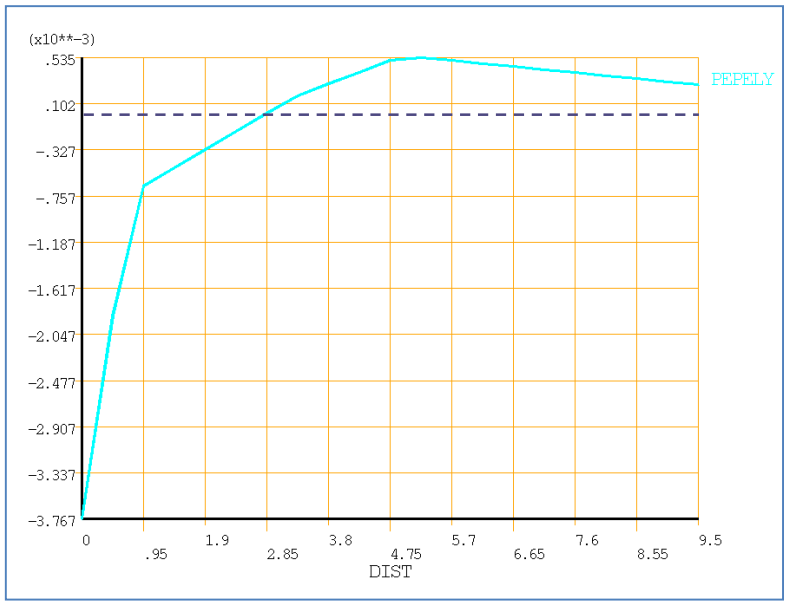
(a) Experiment results (ENGIN_X)



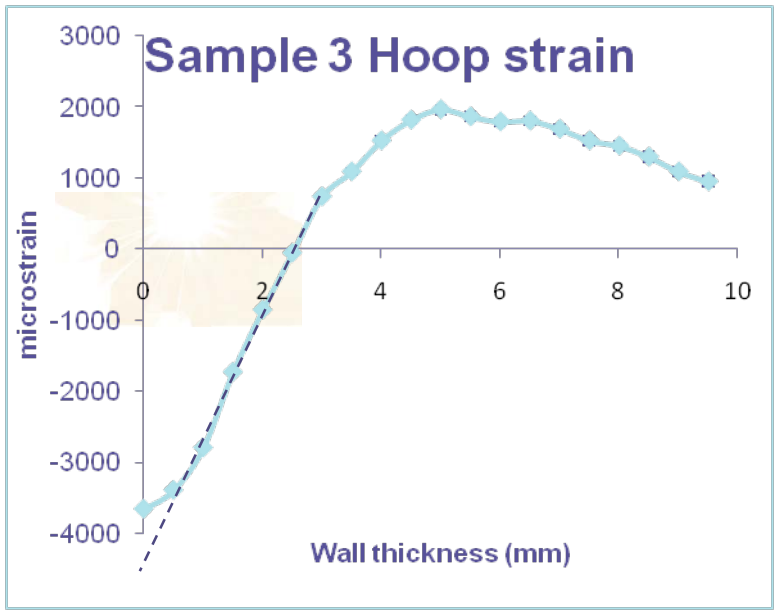
(b) The FEA model

Experiment results and FEA model for sample 4 (**700MPa** autofrettage pressure)

Developing a prototype of 8 kbar inert gas cell.



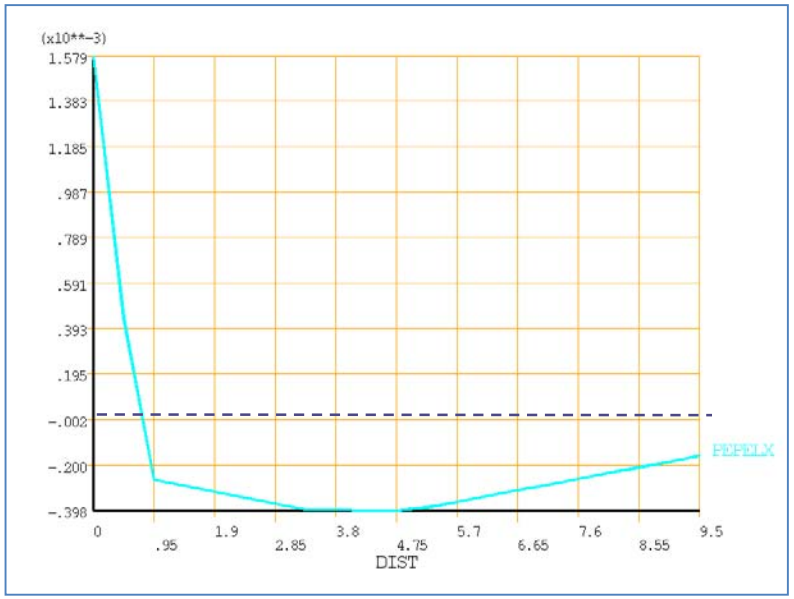
(a) FEA results



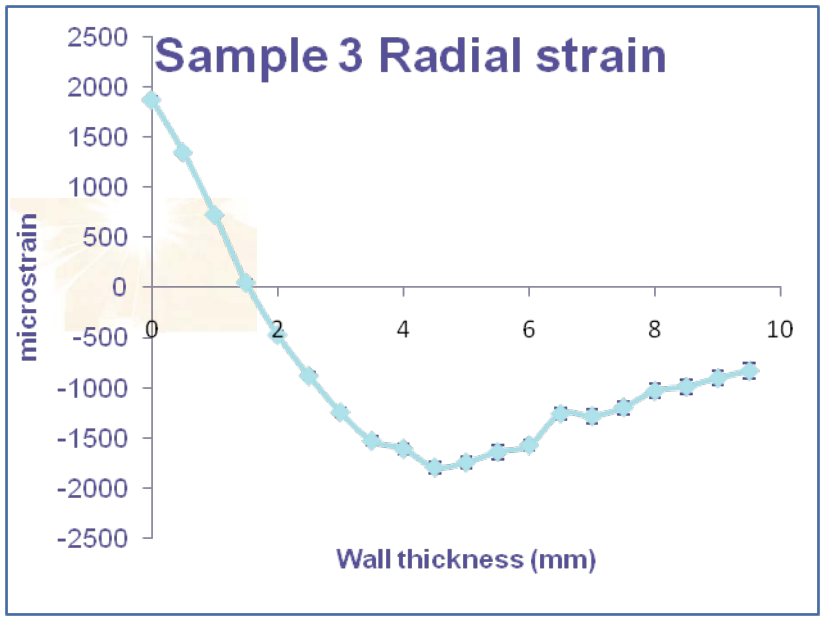
(b) Experiment results (ENGIN X)

Comparison of FEA and Experiment results for sample 3 (under **600MPa** autofrettage pressure)

Developing a prototype of 8 kbar inert gas cell.



(a) FEA results



(b) Experiment results (ENGIN X)

Comparison of FEA and Experiment results for sample 3 (under **600MPa** autofrettage pressure)

Developing a prototype of 8 kbar inert gas cell.

0 kbar | 2 kbar | 6 kbar | 7 kbar | 7.6 kbar

Joint ISIS-Imperial College London project: looking for material for new generation of high pressure cells.

Cell construction materials must be high-strength, hydrogen-compatible, temperature and fatigue resistant. ICL is making for ISIS *tensile, S-N fatigue* and *cyclic stress-strain tests* for **Inconel 718**, **titanium-zirconium** alloys and **beryllium-copper**.

Acknowledgements

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