SINTEF WELL INTEGRITY LABORATORY - TRONDHEIM

Last Updated: 2021-12-10T09:42:08

S.P. Andersensv. 15A, Trondheim, Norway

Operated by

Description

The **Well Integrity laboratory** is installed as part of the Reservoir flow laboratory, with additional facilities that share the flooding rig with several high-performance pumps of the SINTEF SCAL laboratory, as well as the soon to be installed advanced CT scanner. The laboratory consists of several pressure vessels of different diameter, mainly used to study well cement integrity, separately or as composite mini-wellbore assemblies of steal casing, cement sheath and formation rock. The laboratory is equipped with API standard cement and drilling fluid mixers and viscometers. Typical studies performed at the WI-Lab are damage studies, either of cement itself or cement bonding to steel or to rock. This damage occurs as a consequence of temperature or pressure cycles. ECCSEL infrastructure belonging to this laboratory is the S3 Well Integrity infrastructure. It consists of a large pressure vessel, also called mini-wellbore simulator. It allows placement of a steel casing, cement sheath and surrounding rock formation. Independent control of borehole, cement sheath and rock pore pressure is implemented, together with outside confining pressure. It is CT transparent and planned to be inserted in the ECCSEL industrial CT when it arrives. The cell accepts core samples of 290 mm length, outer diameter 90 mm, inner diameter 52 mm, with casing dimensions of 365 mm L, 40 mm OD, and 37 mm ID. Maximum confining pressure is 20 MPa, casing pressure 50 MPa and pore pressure 15 MPa.

Scientific Environment

The WI infrastructure is available for invited researchers, with possibility to use the facilities at SINTEF to prepare on site rock samples, mix cement and instrument the cell as required. Helpful, professional scientists and technicians are eager to assist visiting researchers. SINTEF Industry has implemented and maintains a quality management system which fulfils the requirements of the standard NS-EN ISO 9001:2008 within research and development in materials technology, advanced materials and nanotechnology, applied chemistry and biotechnology, oil and gas, and green energy and process industry.

State of the Art

The mini wellbore simulator is a unique cell due to its large dimensions combined with excellent X-ray transparency from its hybrid outer shell of

CCUS Technologies

Storage

- Leakage
- Pressure/injection
- Leakage mitigation/remediation
- Caprock/well integrity

Research Fields

- Fluid dynamics
- Chemistry/Geochemistry
- Mechanics/Geomechanics

Scale of Facility

- Lab Scale

Research Facility Contact

Pierre Cerasi
pierre.cerasi@sintef.no

ECCSEL RICC Representative

Rune Bredesen
rune.bredesen@sintef.no

Website

http://www.sintef.no/

strong aluminium alloy and composite wrap. This allows for full-field imaging of steel-cement-rock assemblies with no distortions or beam-hardening. The state-of-the-art flow and pump system makes it possible to run complex tests inside the CT cabinet, with the option to follow in real time the placement of cement or remedial fluids or monitoring fracture network propagation.

Areas of Research

- Characterisation of microannuli in between cement sheath and casing or formation
- Investigation of fracturing in cement and surrounding rock formation
- Evaluation of well remediation materials

See also the images above.

Installations

Unit type	Model	Applications
Mini-wellbore simulator	Bespoke	CT-transparent well integrity applied to CCS or oil and gas (P&A)
Rheometer	Anton Paar	For characterisation and adjustment of the rheology of slurries and pastes

Quality Control / Quality Assurance (QA)

http://www.sintef.no/en/sintef-group/a-certified-institute/

Quality Commitment

ISO 9001

WI-LAB (NO3.10)

Facility Availability

Unit of Access (UA)
Day

Availability Per Year (in UA)
120 UA (days)

Forms of Access
In Person, Contract Research, Cooperative Research

Present Facility State of Access
Fully Accessible

Average Duration of a Typical Access
7-14 UA (days)

Operational or Other Constraints

Specific Risks
n/a

Legal Issues
n/a

Selected Publications

2015 - In SPE Thermal Well Integrity and Design Symposium. Society of Petroleum Engineers (2015, November)

Effect of thermal cycling on cement sheath integrity: realistic experimental tests and simulation of resulting leakages.

Vrålstad, T., Skorpa, R., Opedal, N., & De Andrade, J.

2016 - SPE Drilling & Completion, 31(04), 317-326

Experimental laboratory setup for visualization and quantification of cement-sheath integrity

De Andrade, J., Sangesland, S., Skorpa, R., Todorovic, J., & Vrålstad, T.

2014 - Energy Procedia, 51, 56-64

Potential leakage paths along cement-formation interfaces in wellbores; Implications for CO2 storage

van der Tuuk Opedal, N., Torsæter, M., Vrålstad, T., & Cerasi, P.

CCUS Projects

2018-2021 - EU-funded CCUS projects - H2020

SECURe

Subsurface Evaluation of CCS and Unconventional Risks

2016-2024 - Other CCUS Projects - Research Council of Norway

NCCS, Norwegian CCS Research Centre - Industry-driven innovation for fast-track CCS deployment

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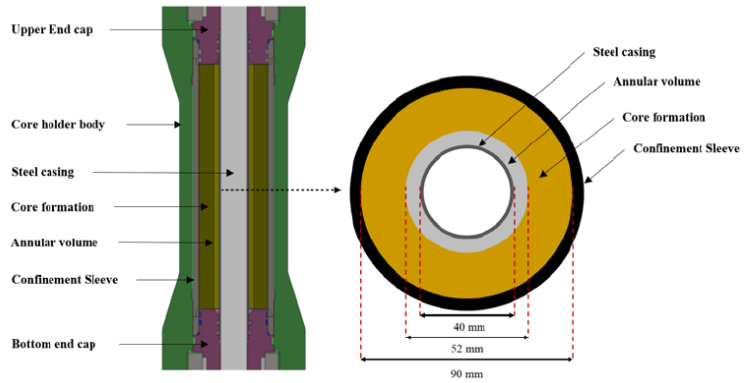
2018-2020 -Main/major non-CCUS projects - National Academies of Science, US

NASEM

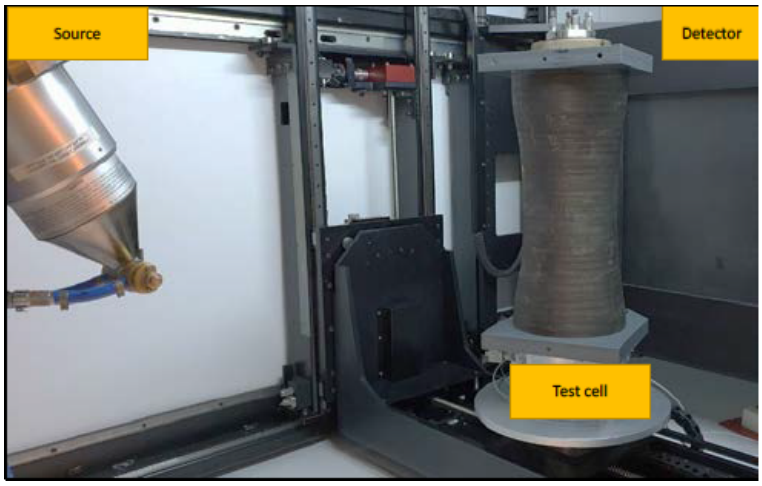
Mitigating Risks to Hydrocarbon Release through Integrative Advanced Materials for Wellbore Plugging and Remediation

Figures



Schematic view of mini wellbore simulator

SINTEF



Photograph of mini wellbore simulator installed in NTNU Industrial CT

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