

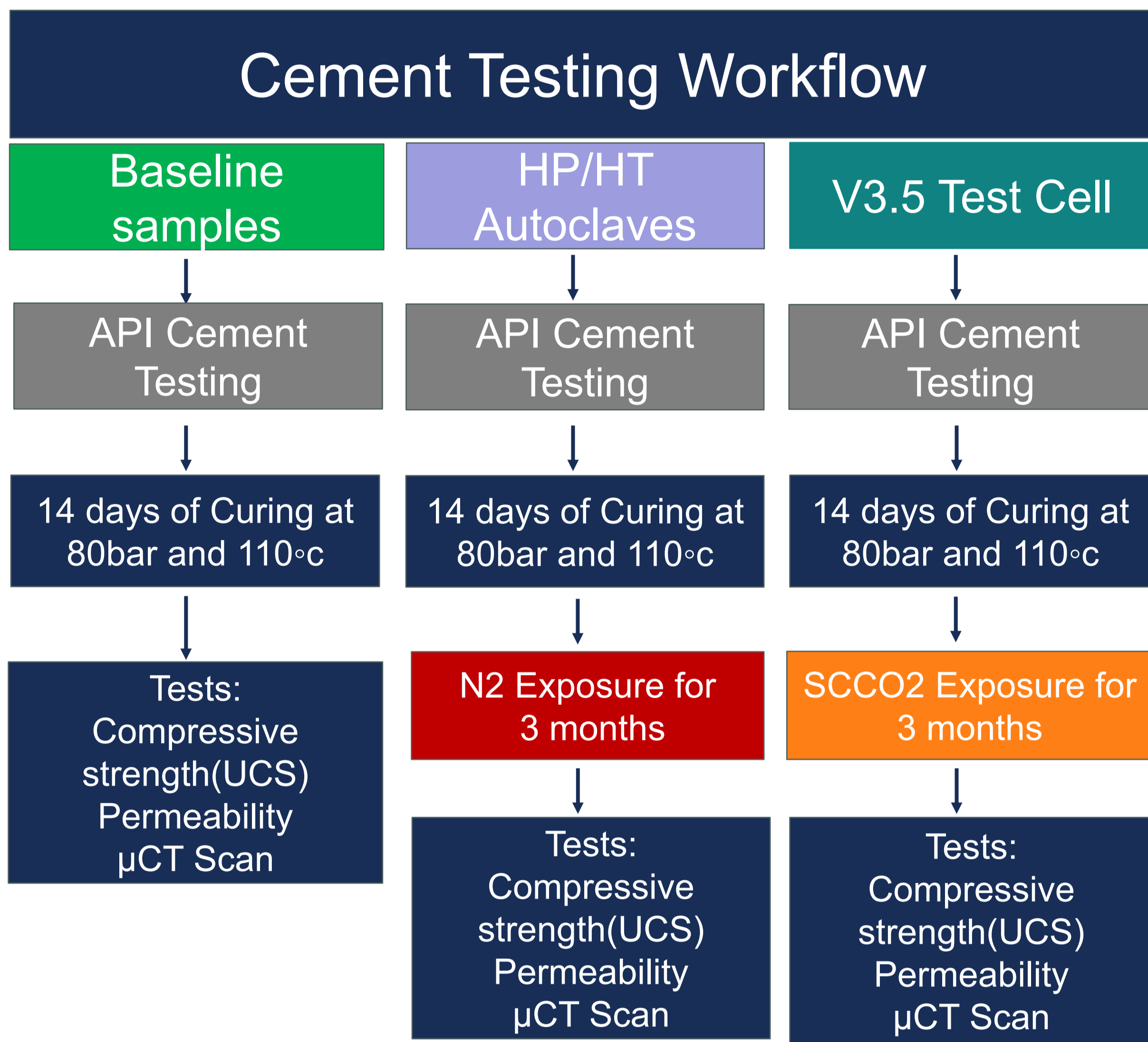
# Supercritical CO<sub>2</sub> (SCCO<sub>2</sub>) exposure on wellbore cement

Experimental framework for evaluating the effects of SCCo2 on wellbore cement integrity

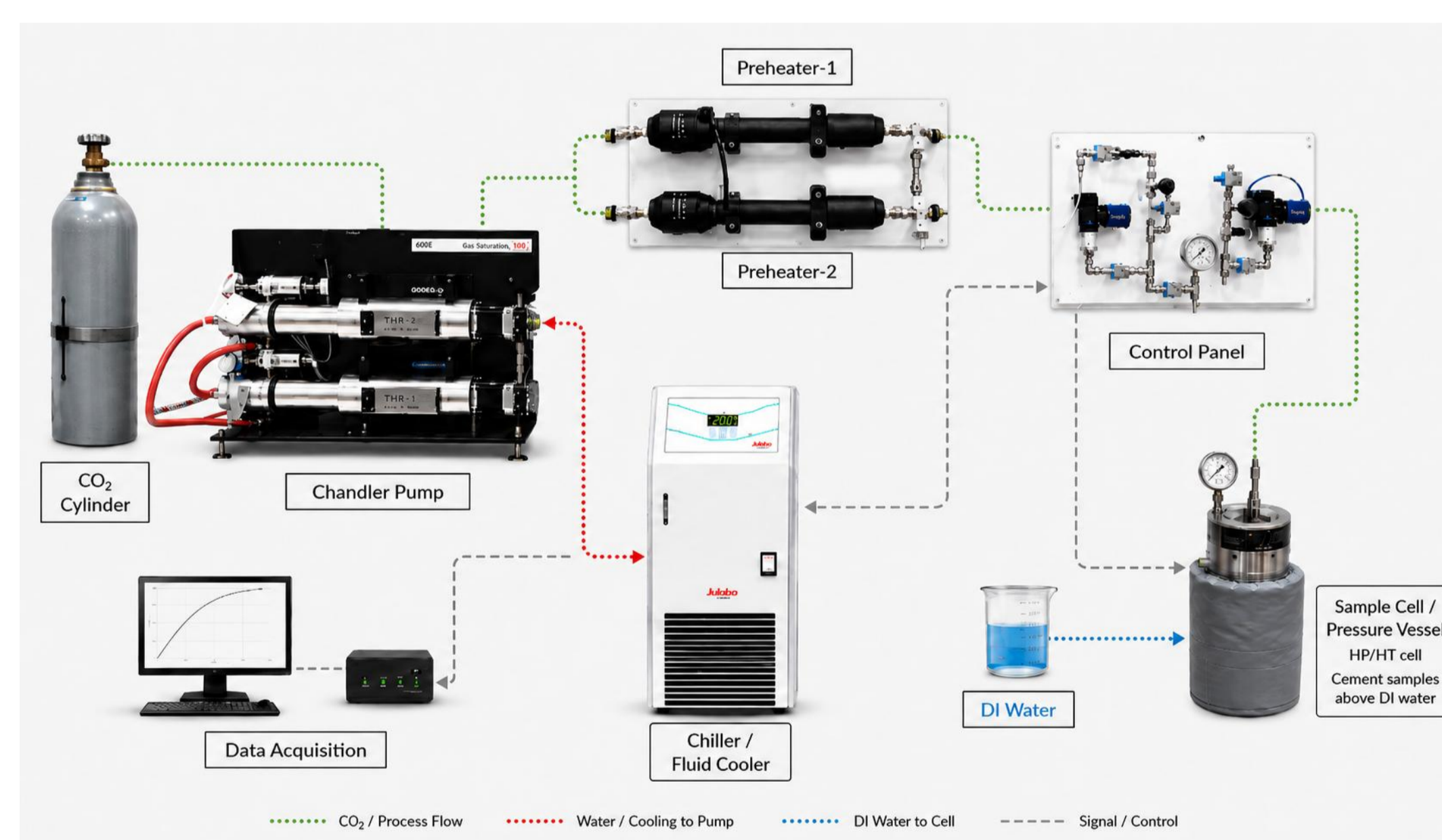
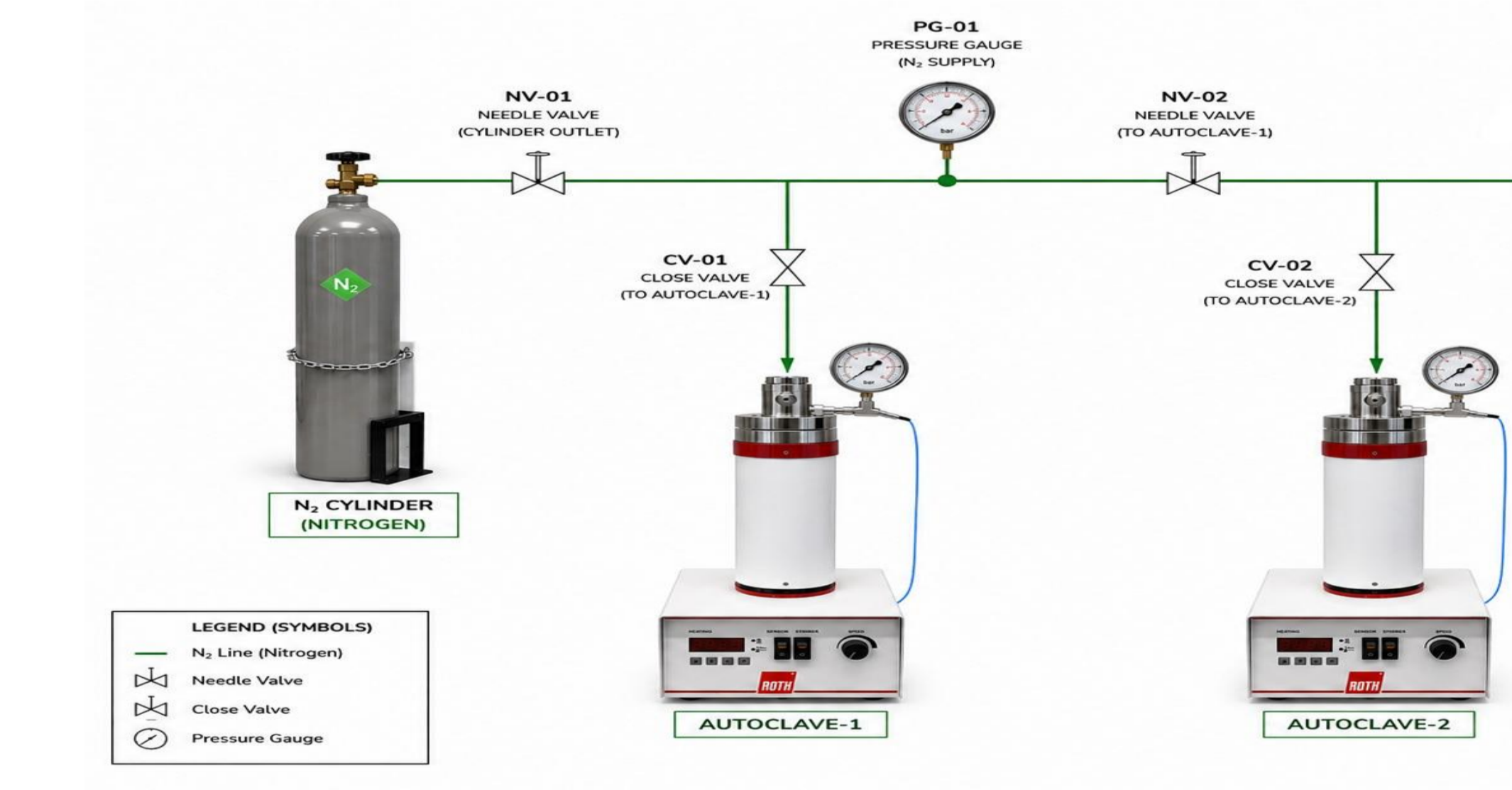
## Introduction

This research aims to evaluate the interaction between supercritical CO<sub>2</sub> (SCCO<sub>2</sub>) and wellbore cement systems used in carbon capture and storage (CCS) applications, focusing on how SCCO<sub>2</sub> exposure affects cement properties, carbonation behavior, and the durability-resistance of cement under downhole conditions.

## Methodology



## Experimental Setup design

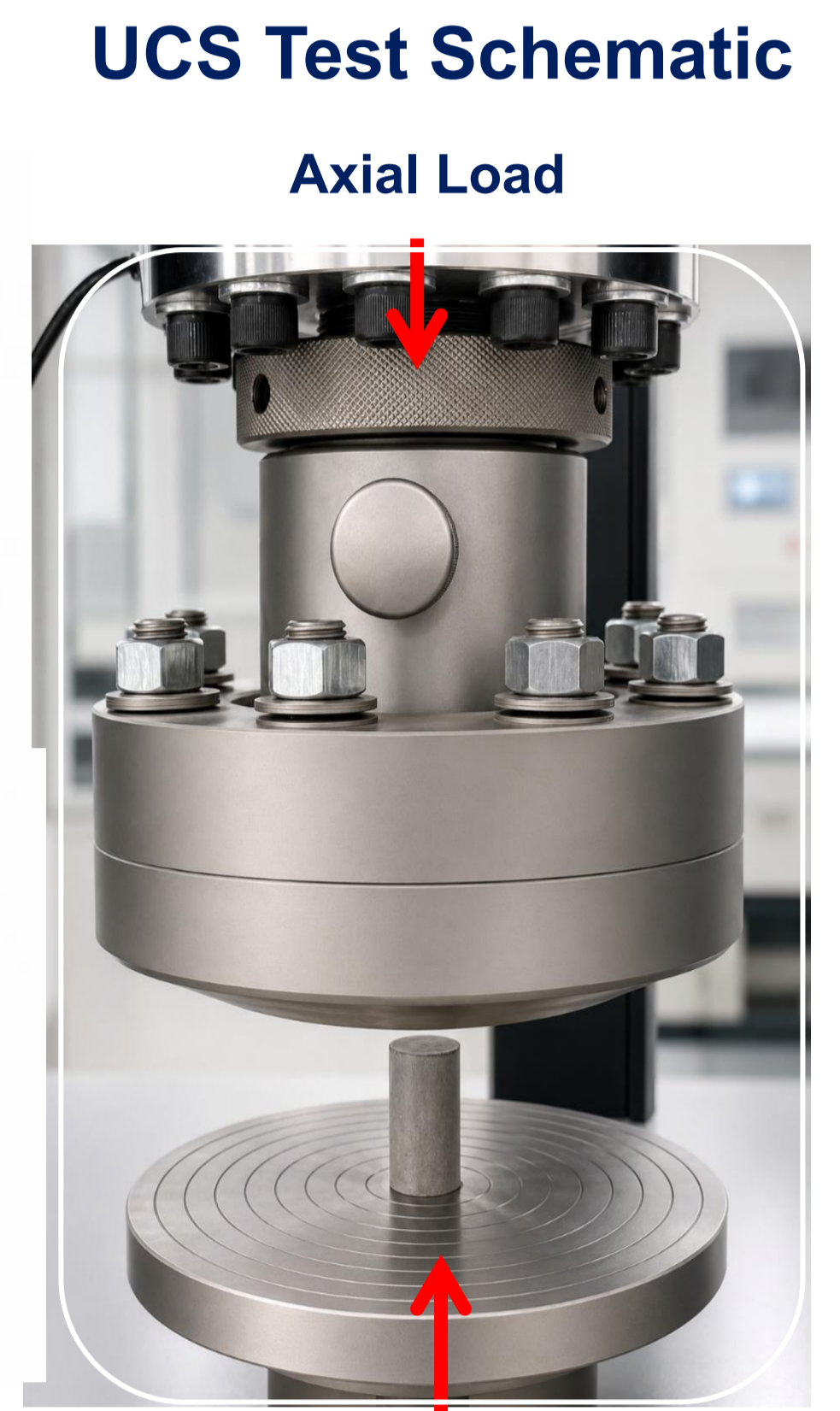


## Experimental Evaluation Tests

### Compressive strength test(UCS)

#### Test Objectives

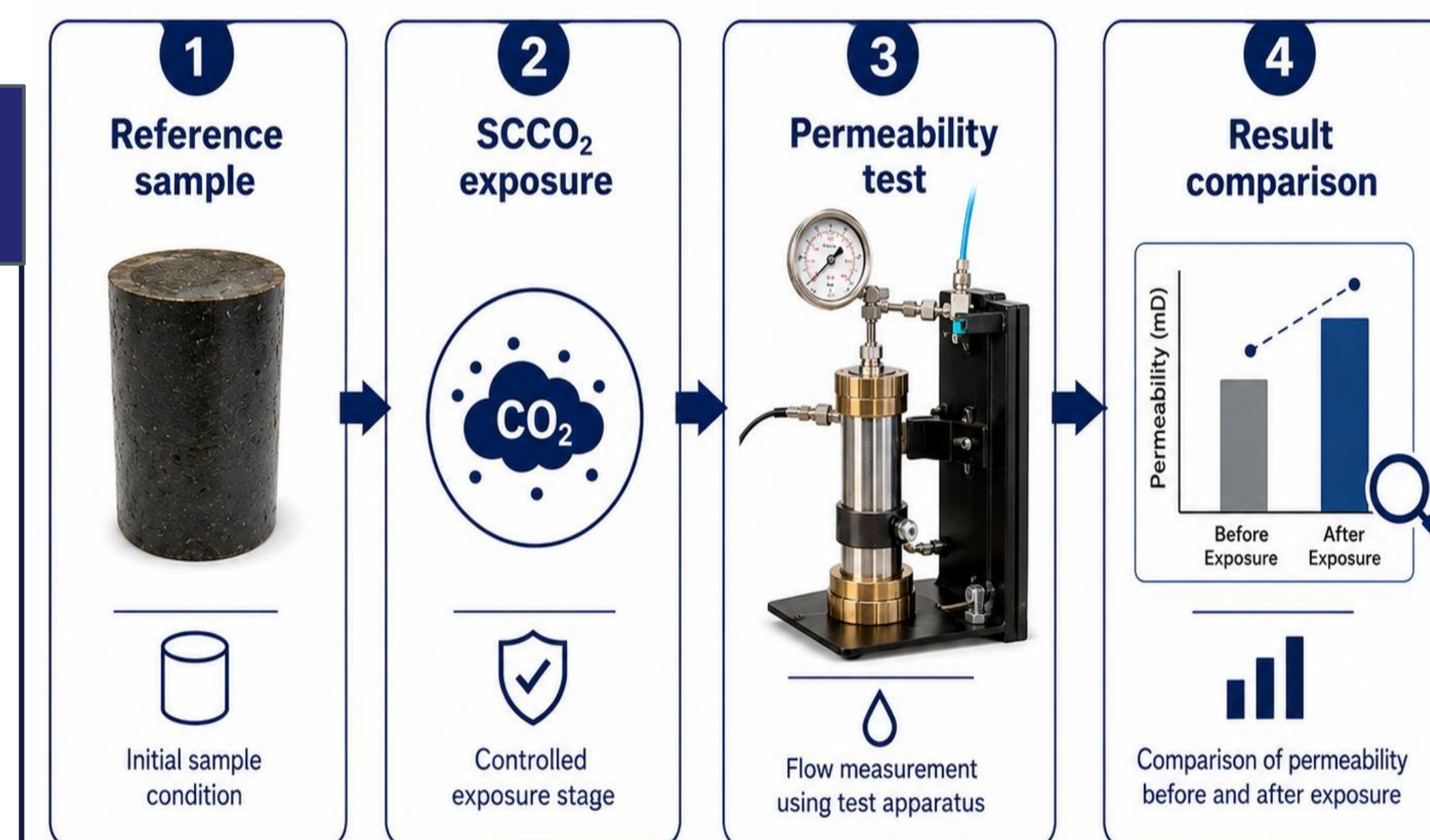
- Determine peak compressive strength of cement samples
- Evaluate the effect of SCCO<sub>2</sub> exposure on strength degradation
- Compare mechanical behavior between reference and exposed samples
- Observe fracture initiation and failure patterns



### Permeability test

#### Test Objectives

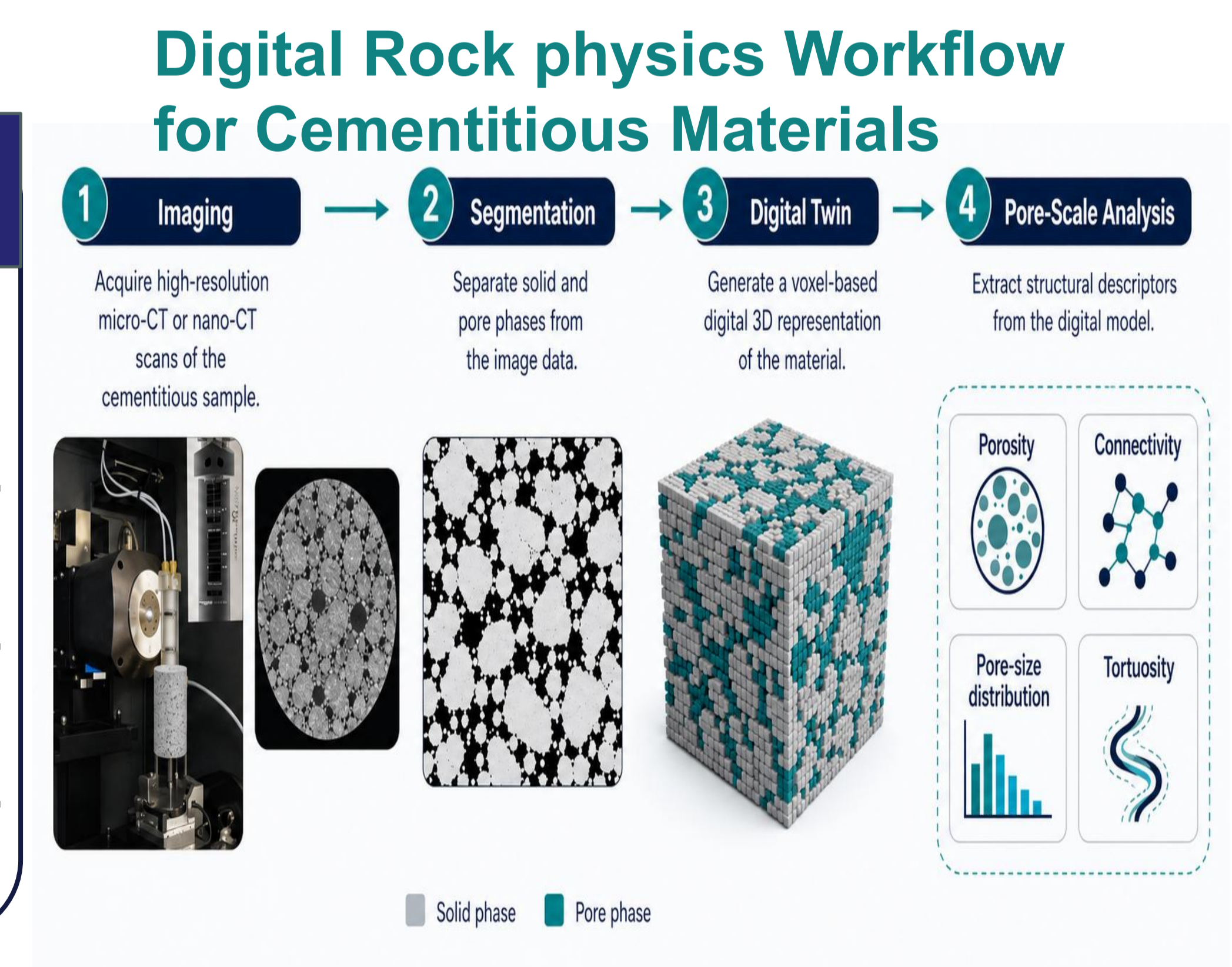
- Investigate fluid transport through the cement
- Evaluate microannulus sealing efficiency after SCCO<sub>2</sub> exposure
- Compare permeability changes before and after SCCO<sub>2</sub> exposure



### μCT scan

#### Test Objectives

- Visualization of microannulus and crack propagation
- Creation of a digital twin from micro/nano-CT imaging
- Identification of carbonation front after SCCO<sub>2</sub> exposure



## Conclusion

Supercritical CO<sub>2</sub> exposure can alter the mechanical and chemical properties of wellbore cement, which may affect cement strength, and long-term well integrity. The integrated workflow provides a more comprehensive understanding of cement performance under CO<sub>2</sub> storage conditions.



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**Research Interests:**

- Cement integrity
- CCS data analysis
- Cement-Co<sub>2</sub> exposure analysis