UNLOCKING THE POWER OF DRILL CUTTINGS ADDS UP

SGS AUTOMATED ROCK PROPERTIES BY INDENTATION (ARPIN) SERVICES
ANALYSING ROCK FRAGMENTS ADDS UP

SUSTAINABILITY

RESERVOIR GEOMECHANICS

SEAL INTEGRITY

BOREHOLE STABILITY

ANALYSIS ON DRILL CUTTINGS

RISK REDUCTION

ROCK MECHANICS

SUSTAINABILITY

COST REDUCTION

ARTIFICIAL STIMULATION

DRILLING

ANALYTICAL EXPERTISE

ADVANCED MINERALOGY

INDENTATION

BOREHOLE STABILITY

SEAL INTEGRITY

RESERVOIR GEOMECHANICS

SGS ADDS VALUE BY INCREASING PRODUCTION EFFICIENCY, REDUCING COSTS AND RISKS, AND BUILDING TRUST
SGS offers a fully integrated and automated workflow delivering a mineralogical and geomechanical dataset coupled with fully modifiable (geomechanical) models. The workflow utilises the strengths of advanced mineralogical analysis (QEMSCAN) with nanoindentation for providing reliable measurements on drill cuttings. Based on measurement results, a digital rock mechanical model at reservoir scale is developed using finite element modelling software providing insights on mechanical rock behaviour without the requirement of core samples.

**ARPIN KEY FEATURES**

SGS’ innovative ARPIN workflow allows the analysis of mineral and mechanical properties of rock fragments as small as 0.1 mm. ARPIN integrates:

- Mineral composition, lithology and textural elements of rock fragments, using the QEMSCAN technology
- Mechanical properties (e.g. Young’s Modulus) by nanoindentation measurements
- Digital model of the rock sample and integration of rock texture and porosity, using 3D software
- Up-scaling of mechanical rock properties to reservoir scale, using 3D finite element modelling combined with available log data
- Simulation and forecast of the mechanical rock properties under varying reservoir conditions, including:
  - Confining (reservoir) pressures
  - Pore fluid density
  - Local stress regime
  - Rock strength

**APPLICATIONS**

- Assessment of mechanical rock properties (e.g. Young’s Modulus, Poisson’s Ratio) for:
  - Completion, stimulation and fracture propagation modelling (e.g. for unconventional reservoirs)
  - Seal and rock integrity assessment (e.g. for optimising geothermal, underground gas storage and CO₂ sequestration projects)

- Completion stability assessment, well integrity analysis and optimised well placement
- Compaction, subsidence and induced seismicity modelling and forecast
- Seismic Inversion:
  - Calibration of rock properties derived from shear wave log analysis
  - Creation of ‘synthetic’ shear wave log based on cuttings

**BENEFITS**

- Linking geomechanical properties to mineralogical composition supports enhanced reservoir characterisation, leading to high-grade geomechanical models at relatively low costs
- Cost reduction in sample acquisition and preservation, including a reduction of the risks associated with obtaining core samples and the opportunity to carry out geomechanical studies on archived drill cuttings material
- Availability of drill cuttings samples over the entire well trajectory allows the development of representative geomechanical models:
  - In the absence of core, or to complement models based on core triaxial test results
  - For the full well trajectory, including seal/overburden sections
  - That better capture (reservoir) heterogeneities facilitating enhanced model calibration
- Flexible (finite element) modelling approach allows testing of multiple scenarios (e.g. different reservoir conditions)
- Fast turnaround time
- Increased understanding of subsurface stress variations during life of field resulting from production and injection

**SGS ADDS UP**

SGS is the world’s leading inspection, verification, testing and certification company. Recognised as the global benchmark for quality and integrity, we employ over 97,000 people and operate a network of more than 2,600 offices and laboratories around the world. We are constantly looking beyond customers’ and society’s expectations in order to deliver market leading services wherever they are needed.

We provide innovative services and solutions for every part of the oil, gas and chemicals industry. Our global network of offices and laboratories, alongside our dedicated team, allows us to respond to your needs, when and where they occur. Our reputation for independence, excellence and innovation has established us as the market leader in providing services that improve efficiency, reduce risk and deliver competitive advantage for you.

**FOR MORE INFORMATION ON SGS ARPIN SERVICES, CONTACT NL.SUBSURFACE.SALES@SGS.COM OR VISIT WWW.SGS.COM/OGC**