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The Window In: Microscopy and Scanning Techniques for Reservoir Definition and Resource Recovery

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Summary

Microimaging of solid materials is a versatile tool used to provide insight into all stages of resource recovery including greenfield exploration, preliminary reservoir and cap-rock integrity studies, monitoring drilling operations and identifying scale precipitates, well remediation, full scale production and finally post-recovery procedures such as tailings monitoring. Imaging techniques, including microscopy, delve into lithological features at a much finer scale than core logging which provides general interpretation of depositional environments and core structures at a macro scale. Mineral identification through optical mineral properties and semi-quantitative elemental data collection can also aid in well log interpretation when considering single well or regional scale correlations. Microscopy is a powerful tool for analyzing pore networks, fines migration potential and other fluid-rock interactions. With reservoir characterization, understanding the rock compositions and potential for problems during production can be used to mitigate expensive remediation processes during the life of a well. In mining operations, image analysis provides valuable information to evaluate rock morphology, ore liberation potential and recovery efficiency. When used in conjunction with other chemical and petrophysical data sets such as routine core analysis, X-ray Diffraction (XRD) and X-ray Fluorescence (XRF) inferences toward reservoir quality and well performance can be drawn to form a cohesive understanding of the target formation.

Methods

Several microscopy techniques are commonly used within the oil and gas or mining industries, each with varying resolution capabilities. Methods include binocular microscopy, suitable for geological hand samples and petrographic microscopy for thin section samples. High resolution options such as Scanning Electron Microscopy (SEM) require polished thin sections and grain mount samples, while automated systems such as Quantitative Evaluation of Materials by Scanning Electron Microscopy (QEMScan) are suitable for epoxy mounted samples and polished thin sections. Non-destructive tests such as Computed Tomography scanning (CT scanning) image whole diameter core and create three-dimensional models of the internal core structure by defining sample density. This poster aims to highlight the advantages and disadvantages of each technique and highlight the benefits of incorporating a multi-process approach when performing imaging for reservoir and mining evaluations.

Conclusions

Microscopy studies form the basis of high-resolution lithological interpretation, and with supplementary chemical and petrophysical testing provides inexpensive detailed information that can allow for the design of optimal drilling procedures and mining operations from initial planning stages to post-production monitoring.