## Chemistry and Rheology of Interfaces

### Interface Type

<table>
<thead>
<tr>
<th>Bulk Mineral-Fluid Interfaces</th>
<th>Nanopore-Fluid Interfaces</th>
<th>Fluid-Surfactant-Fluid Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh mica scCO₂ H₂O</td>
<td>diatomite smectite</td>
<td>CO₂-organic foam</td>
</tr>
<tr>
<td>Reacted mica H₂O</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Current Model

- Water
- Methane
- Quartz

### Field-Scale Impact

- Oil extraction or CO₂ sequestration
- Unconventional resources
- Reduced water use in HF

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**Note:** The images depict various interfaces and their corresponding models and impacts.
Interface Science with Diamond NV⁻ Centers

Application to Interface Science

Physical and Chemical Measurements
- Viscosity from solvent $^1$H NMR relaxometry
- Solute speciation from ($^{13}$C, $^{31}$P …) NMR
- Pressure and strain

Laboratory Capabilities

In Situ Experiments
- 1 bar – GPa
- 0°C – supercritical water

Extensions

Nuclear hyperpolarization
- Optical manipulation and NMR spectra/imaging
- Microfluidics $\rightarrow$ cores $\rightarrow$ field

Nanodiamonds
- Surfactant interfaces
- Functionalization