RheoSANS at the NIST-CNR

B Greenwald NIST/UMD, Gaithersburg MD, USA
The Rheometer

- Paar Physica USD200*
- Radial and tangential configuration
- Quartz or titanium Couette type flow cells
- Gaps of 0.5 or 1mm
- Temperatures ranging from –20°C to 150°C
- Solvent trap preventing solvent evaporation

* The mention of commercial equipment does not imply endorsement by the National Institute of Standards and Technology
Radial and Tangential?

NIST, NG-7, stress control rheometer

- Radial: Perpendicular to Shear Velocity
- Tangential: Parallel to Shear Velocity
Quartz vs Titanium

Thickness used 1 mm for all of them
Slit Packages and Alignment

- Radial aperture and tangential slit package
- Boron Aluminum backed with Cadmium
- 1 cm aperture for radial measurement
- 0.3, 0.5, 0.6, 0.8 mm tangential slits
Slit Packages and Alignment

- 2 micrometer screws in the X and Y plane and 2 screws to adjust the tilt aid in alignment of cup with bob
Slit Packages and Alignment

- Transmission measurements across gap
- Changes are interception with material boundaries
- Alignment indicated by arrow marked “slit edge”
## Technical Attributes

### Technical Specifications

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>1% of maximum value</td>
</tr>
<tr>
<td>Minimum Torque</td>
<td>150 mNm</td>
</tr>
<tr>
<td>Torque Resolution</td>
<td>0.01 µNm</td>
</tr>
<tr>
<td>Speed Range</td>
<td>$10^{-4}$ to 1000 min$^{-1}$</td>
</tr>
<tr>
<td>Shear Rate Range</td>
<td>$1.3 \times 10^{-4}$ to $4.8 \times 10^3$ s$^{-1}$</td>
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<tr>
<td>Shear Stress Range</td>
<td>0.67 to $3.5 \times 10^4$ Pa</td>
</tr>
<tr>
<td>Viscosity Range</td>
<td>$1.7 \times 10^{-3}$ to $2.7 \times 10^8$ Pas</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>-20 to 90 °C</td>
</tr>
<tr>
<td>Volume</td>
<td>8, 12 mL</td>
</tr>
<tr>
<td>Gap Size</td>
<td>0.5, 1 mm</td>
</tr>
</tbody>
</table>

- **Temperature control by passing heated N2 gas by the cell**
- **0.5 and 1 mm gaps requiring 8 and 12 mL respectively**
- **Solvent trap to prevent evaporation of solvent during experiment**
1-2 Plane Shear Cell
1-2 Plane?

- Parallel to Vorticity direction
- Degree of Structural Anisotropy
- Direction of Anisotropy within the plane

NIST, NG-7, stress control rheometer
The Guts

• Quartz windows
• Temperature range –10 to 90 C
• 1.5 mm Gap
• Sample loading
The Assembly and Technical Attributes

**Technical specifications:**
- Path length 5 or 7mm
- Gap 1.5mm
- Sample volume ~10ml
- Slit 0.2,0.4 mm x 3mm
- Shear rate 0.01-500s⁻¹
Thanks!

www.ncnr.nist.gov/sans/programs/equipment/rheometer.html

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