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SUPPLEMENTARY INFORMATION

Isotropic - nematic phase transition of polydisperse clay rods

Phillip Woolston and Jeroen S. van Duijneveldt

STANDARD DEVIATION IN ASPECT RATIO

As the length and diameter are independent Eq. 1 can be used to calculate the standard deviation in the aspect ratio.

\[ \sigma_{L^*/D^*} = \left( \frac{\langle L^* \rangle}{\langle D^* \rangle} \right) \times \left[ \left( \frac{\sigma_{L^*}}{\langle L^* \rangle} \right)^2 + \left( \frac{\sigma_{D^*}}{\langle D^* \rangle} \right)^2 \right]^{1/2} \]  

(1)

The standard deviation in the average \( \langle L^*/D^* \rangle \) then follows from Eq. 2, where \( N \) is the number of particles counted in analysing the TEM images.

\[ \sigma_{\langle L^*/D^* \rangle} = \frac{\sigma_{L^*/D^*}}{\sqrt{N}} \]  

(2)

PHASE DIAGRAM - ERROR ANALYSIS

As the value of \( \phi_I/\phi_N \) is taken from extrapolations of the linear trend line for the nematic fraction as a function of rod volume fraction it is possible to rewrite this in terms of the gradient and intercept of the trend lines as seen in Equations 3 to 5 where \( a \) is the intercept of the line and \( b \) is the gradient, listed in Table I. This allows evaluating the standard deviation in these parameters.

\[ 0 = a + b\phi_I \text{ and } 1 = a + b\phi_N \]  

(3)

which rearranges to

\[ \phi_I = \frac{-a}{b}, \phi_N = \frac{1 - a}{b} \]  

(4)
so
\[
\frac{\phi_I}{\phi_N} = \frac{-a}{b} = \frac{-a}{1-a}
\] (5)

The standard deviation of \(\phi_I/\phi_N\) then follows as

\[
\sigma_{\frac{\phi_I}{\phi_N}} = \sigma_a \times \left| \frac{\partial \frac{\phi_I}{\phi_N}}{\partial a} \right|
\] (6)

\[
\sigma_{\frac{\phi_I}{\phi_N}} = \left| \frac{(-1) \times (1-a) - (-a) \times (-1)}{(1-a)^2} \right| \times \sigma_a = \left| \frac{a - 1 - a}{(1-a)^2} \right| \times \sigma_a = \frac{\sigma_a}{(1-a)^2}
\] (7)

**REFERENCES**

TABLE I. Data obtained by linear regression applied to the nematic fraction as a function of the core volume fraction.

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<tr>
<th>Clay</th>
<th>b</th>
<th>(\sigma_b)</th>
<th>a</th>
<th>(\sigma_a)</th>
<th>(\langle D^<em>/L^</em>\rangle)</th>
<th>(c_{50})</th>
<th>RSD</th>
<th>(\Phi_I/\Phi_N)</th>
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