

Q&A Group 10.07.2020

In this section, all your questions have been categorized to be answered more efficiently.

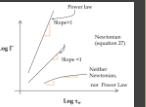
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Correction Approaches

- What is the "b" parameter and its value in the $((3+b)/4)\Gamma$ (Rabinowitch correction)? In the Brookfield Viscometer test, I think we should use specific container with specific volume of the material inside it, right? -Javid Azimi Boulali

the parameter b is the slope of the curve in the $\log \Gamma$ vs. $\log \tau_w$ at the wall. If $b=1$ (Newtonian fluid), then the shear rate at the wall is the same as the apparent shear rate.



I do not understand your question about the specific volume

- The power law model is only applicable for certain materials, therefore the Rabinowitch method is not a generalized system to find out the real properties of the material. How do we solve this? -Neda Karami

In the $\log \Gamma$ vs. $\log \tau_w$ you have a third option, in that case the slope is stress dependent and you have different values of b for each measurement and you will have to adjust one by one the values to get the true shear rate at the wall

- Which other correction methods will give us a more generalized definition? Based on other non-Newtonian models? -Neda Karami

See the previous answer

- How the Rabinowitch and Bagley corrections are applied to a power-law fluid? -Julio Romero-

When you use the correction: $\dot{\gamma}_w = \left(\frac{3+b}{4}\right)\Gamma$, if b is constant, that is the slope is constant when you plot $\log \Gamma$ vs. $\log \tau_w$ then you are working a power law fluid. The Bagley corrections are conducted by having the extrapolations to $L/D=0$ for EACH shear rate.

- Is it completely necessary for all the cases to make both corrections (Rabinowitch and Bagley)? -Bryan Quintanar- Yes
- I would like to know the answers for the problems at the end of Rabinowitch and Bagley video. -Juan Jesús Rocha- Let us see it at class
- After your explanation in the class, I understood the concept of both correction and why we need them. But for Bagley part, I cannot find the relation between "high/low shear rate" vs. "L/D" vs. "Load" (The curve) -Elnaz Hosseinzadeh The reason is that $\Delta P_{\text{entrance}}$ is shear rate dependent (or in other words flow rate dependent). The higher the flow rate the more difficult is to stretch the polymer chains in the sudden contraction zone.

Oscillatory rheometer

- In the use of parallel plate rheometer, during the setup data: what is the angle of frequency from 1,000 rad/s to final 0.5 rad/s? and why it is important?- *Marino In that tye of test you have to do a frequency seep and n any case what you do is to set up the percenage of displacement (10% of a radian)*
- For the oscillatory rheometer all the set ups are the same for all the tests?- *Miguel Alejandro Typically yes, but you can adjust the gap if needed as well as the % of strain (displacement). In any case you should be aware if the region is in the lienar viscoelastc beahvor or outside that range. If you adjust the gap, the equipment has the equations et up to do the calculations and give you the data*
- In Oscillatory Rheometer (the third device in the film, which its sample was like a disc) I did not get what is “Angular Frequency”. Because to me, the angle of the two plates were fixed and were parallel to each other.-*Elnaz Hosseinzadeh. I will explan that in class but is related to the first answer in this slide.*

Brookfield Rheometer

- How does Brookfield viscometer, calculates the viscosity from torque and velocity? Is there any formula that can define the relationship between torque and viscosity? Also, in this instrument, why do we need to use a spindle with larger area for less viscous materials and vice versa? - *Seyedehniousha Mousavi*

About the equations, I will post a Presentation about viscosity, so you can see it there. For the other question, yes, It is better to have a larger area for low viscosity materials

- With the Brookfield viscometer, Is it important the height at which the spindle stays inside the fluid? I mean it could be at the top of the fluid, bottom or middle, is it the same? - *Bryan Quintanar- it has to be submerged, and have marks up to where to submerge it*
- In Brookfield viscometer, Benjamin receive tree modulus of viscosity with the same spindle at different torque. Could you please explain about the torque and its impact? - *Elnaz Hosseinzadeh The torque is related to force and therefore to the shear stress, then three different torques give three different shear viscosities (if you are in Non Newtonian region)*

Newtonian and Non-Newtonian behaviors

- The guy in the video says honey is a newtonian fluid and most researchers classify it as non newtonian due to its thixotropic behavior, what do you think? –Marcos Salazar- **Do you have evidence that honey is thixotropic? The regular honey is Newtonian unless you have different sugar crystals.**
- For a Newtonian fluid, why the value of viscosity remains the same with the changes in torque?- Seyedehniousha Mousavi- **Because, there is no change in entanglement density**

Modulus

- What is the complex modulus?-*Julio Romero- is related to the vector representation of the relaxation modulus in the complex domain*
- I still have some troubles understanding the differences of Relaxation modulus and Compliment creep, both are for the maximun strain by stress unit. But if they are different, why are sometimes used as the same or compared between them?-*Diego Ceciliano- Let us see it in class*
- Could you please also explain the storage modulus G' and the loss modulus G'' ? I have read that the intrinsic viscosity is in function of the molecular weight. However the model (viscosity = $k * \text{molecularWeight}^a$) has two empiric constatns. How are this constants (k and a) obtained for a given polymer solution?-*Osamu Katagiri- Let us see it in class*
- What does the relaxation modulus represent, like what we need this value for?-*Miguel Pérez- let us see it in class*

Capillary test

- In the presentation ""Capillary Rheometry-2"", slides 20 and 21. I did not realize how the data in is translated from the plot in slide 20 to the plot in slide 21. In other words, how does the 'load' values are converted into 'viscosity' values?-
Osamu Katagiri- Load is force applied , then you have to convert that to stress and correlate that to the flow and this to shear rate.

Others

- In what other campus are the instruments for capillary test and rheometer test? -*Diego Ceciliano*- *Don't know exactly (I think CEM and Queretaro might have some)*
- The momentum balance equations (25 equations of the last slides) are obtain by the behavior of the polymer into the barrel's rheometer? or into the die's rheometer? -*Juan Jesús Rocha*- *Die*
- I need more explanation on Creep Curve & Recovery Curve. -*Elnaz Hosseinzadeh* *Let us see it in class*
- If the test are already stablished by ASTM, what happen if I use different weight measurements to obtain the viscosity results? The ASTM have stablished test for composite polymers? - *Diego Ceciliano*- *Different materials have different norms*
- In the curve obtained from the combination of results from parallel plate rheometer and capillary rheometer, can we conclude that the typical viscosity curve with the higher zero shear viscosity has higher molecular weight? And if yes considering $PDI = M_w/M_n$, can we conclude that the PDI is higher for those curves with higher zero shear viscosity? -*Syedehniousha Mousavi* *No. The PDI is related to M_w/M_n ratio.*
- How the equipment keeps the strain constant? -*Miguel Pérez*- *Electronics*