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2026 Get Wet

MCEN 4151 - 001

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2026 Get Wet Report

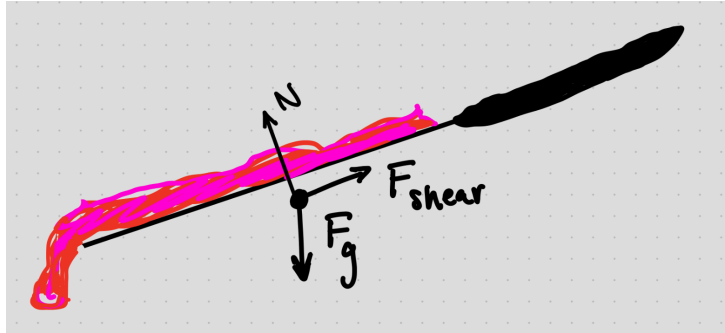
My counter is sticky. It's only in one area where I always make my morning PB & J bagel. I swipe my knife into the jar, and as it moves toward the bagel, some jelly slides off and splatters on the counter. For my Get Wet image, I wanted to capture the jelly moments before falling off. The non-newtonian nature of the liquid causes it to move in a less predictable way than standard fluids making it interesting to capture pictures of. As I was taking pictures I noticed the shadow the knife and jelly casted in the background reminded me of old horror



movies that used shadows to scare the audience rather than just showing what was happening. I thought this was a fun component so I decided to include it in the image.

Fluid Analysis

The non newtonian fluid exhibited highly viscous flow down the knife until it reached the end where it dropped off. The butter knife used is approximatley 7 inches long and $\frac{3}{4}$ inches in width at the largest part of the knife. Gravity is what is causing the jelly to slide down the knife.



Jelly is specifically a psuedoplastic fluid meaning that it gets runnier as more force is applied to it. So, the greater the shear force is acting on the jelly the quicker it will slide down the knife (Basu 2010).

$$Bm = \frac{\tau_y * L}{\mu * V} = \frac{40 Pa * 0.0085 m}{8Pa -s * 0.08m/s} = 0.5$$

τ - Loyal Industries

τ_y - yield stress L = height of jelly

μ - AxFlow

μ - viscosity V = velocity

The Bingham number is used to describe when a fluid is acting more like a fluid or a solid which is very appropriate for this situation because the image is capturing when the fluid is sliding fast enough to fall off the knife. I found the yield stress (τ_y) from Loyal industries, the viscosity (μ) from AxFlow, the length I approximated from looking at my image as $\frac{1}{3}$ inch on average, and finally looking at the burst photos I took I determined that the jelly moved about a pinky nail width from one photo to the next indicating it moved 8 mm in 0.1 seconds meaning it moved .08 m/s. When Bm is $\ll 1$ it means the liquid is acting like a fluid rather than like a solid (Process

Associates). Given a rough calculation of 0.5 it was acting somewhere in between a fluid and a liquid which sounds right given the conditions.

Imaging Techniques

The picture was taken in my kitchen using only the over head lights. It was later at night so, there was no outside light coming into the room. I used my iPhone 15 camera to take this



picture using no zoom so the diagonal FOV was 79.5

degrees (about 69.4 degrees horizontally and 49.6

degrees vertically). The tip of the knife was

approximately 9 inches away from the camera lens

which had a focal length of 26 mm. The original image

was 4032 x 3024 and was cropped to 2505 x 2621. The

aperture was 1.6, the ISO was 400, and a shutter speed

of 1/40 s. I did my image processing on the iPhone app

by changing the brilliance to 28, highlights to -4,

shadows to 5, contrast to 6, brightness to -9, black point to 63, and saturation to 13 all, yielding the image above.

Reflection

The image to me shows the flow of the jelly as it transforms from moving like a solid to moving like a liquid to fall off the knife. The high resolution of the jelly on the knife in comparison to the jelly falling shows the difference in the speed of the jelly falling when it is more liquid in comparison to when it is more solid. If I could change the image I would change the angle I took the image from so that the shadow in the background is less distracting and you can see more of the knife. I am curious how the velocity of the knife changing its angle effects the velocity and shear force of the jelly sliding down the knife.

Citations

AxFlow, <https://www.axflow.com/support/engineering-toolbox/viscosity-in-the-food-beverage-industry/>

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Process Associates, https://processassociates.com/process/dimen/dn_bin.htm

Santanu Basu (2010), Rheological, textural, micro-structural and sensory properties of mango jam, <https://www.sciencedirect.com/science/article/pii/S0260877410002189>