MCEN 4151: Flow Visualization

Section 001

Get Wet Report

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The Get Wet assignment was our opportunity to get our feet wet and dive into capturing fluid physics via camera. The main goal of this assignment was to capture any sort of fluid phenomena in a high-quality picture. I was very interested in the fluid phenomena known as the Chemiluminescence Effect, where light is emitted by means of a chemical reaction. I thought this would be an interesting feature to capture in a dark room because the light emitted by the chemical reaction would serve as a creative and aesthetically pleasing source of light in the image.

In order to capture this effect, I took three 22" glow sticks and applied a bending moment to each stick in turn activating the glow sticks luminescent properties. Then, I took a pint-sized glass filled halfway with water, cut off the both ends of the glow sticks with scissors and poured the glow stick fluid, also known as "bis oxalate", into the glass. As I poured the bis oxalate into glass of water, it began to clump up and sink downward as this particular fluid is denser than water and the weight of the fluid itself is greater than the buoyant force. This experiment dually captured both the Chemiluminescence Effect described by *Eq(1)* and the effect of density on fluid flow. When two reactants are excited by a reactive intermediate, light emission is the result.

$$[A] + [B] \rightarrow [\Diamond] \rightarrow [Products] + light \tag{1}$$

Not only is light emitted in this chemical reaction, but the density of the glow stick clumps compared to the density of the water can be visualized in the free body diagram shown in **Fig.1**

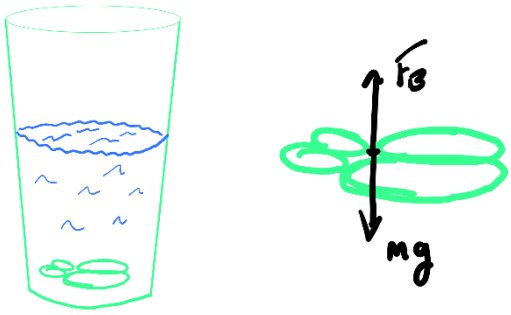

Fig.1 Sketch of glass with Free-Body-Diagram of bis oxalate under motion

Since the weight (mg) of the bis oxalate is greater than that of the opposing buoyant force (F_b), it sinks to the very bottom of the glass. As for the lighting used, the photo was taken in a completely dark room with most of the lighting coming from the activated glow stick particles.

This photograph was taken about one foot away from the glass at a focal length of 36mm, an exposure time of 1/5s, a maximum aperture of 4.5, and an f-stop of f/4.8. A Nikon d3500 DSLR camera was used to capture this 4,000 x 6,000-pixel image. I wanted the photo to be asymmetric because it allowed me to establish a background even though the photo was taken in darkness. I sprinkled leftover glow stick residue on the tablecloth the glass was sitting on in order to create an extraterrestrial atmosphere. During the post-production phase, I used Nikon ViewNX-i photo editing software to edit the contrast of the photo, so that the green illuminating light really stood out against the black background. I also added a color booster to the photo so that the green was less dull and more neon colored. The difference after post-production can be visualized in **Fig.2**

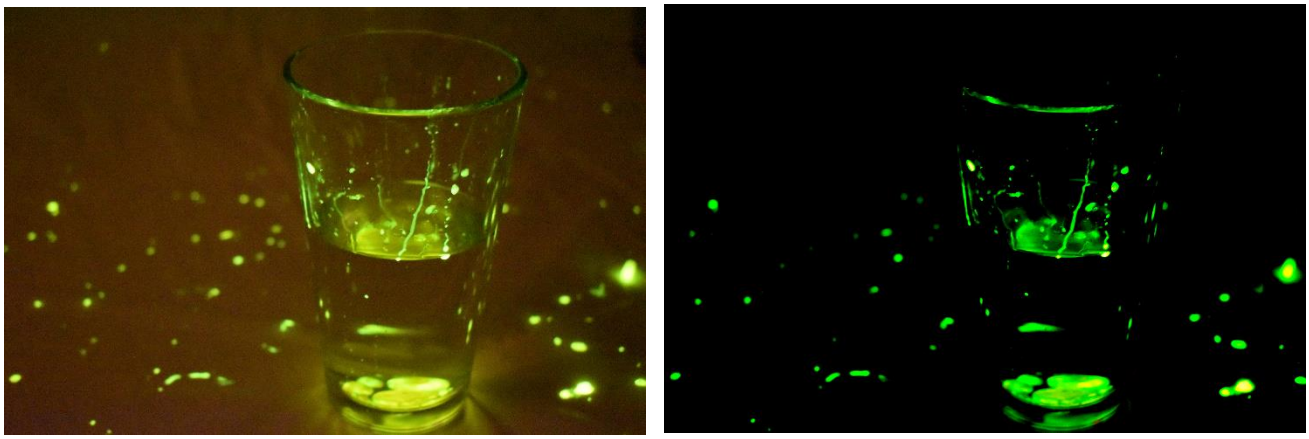

Fig.2 Side by side comparison between the image without image editing (left) and with image editing (right)

Overall, I am pleased with the image I ended up with. I successfully portrayed an image where the main source of light was coming from within the image itself while also capturing the innate phenomena of what happens given a density differential among two fluids. I dislike how in the post-production image, the outline of the glass disappears, and you cannot decipher what is going on without context. My intent was fulfilled, however, to improve the photo I would have liked to capture the bis oxalate while it was falling midway to the bottom whereas in the image I currently have, the fluid has already settled at the bottom of the glass. This would have also allowed me to experiment with different shutter speeds in order to find the optimal setting where the clumps of glow stick fluid were clearly captured.