Athena Ross
Flow Visualization

Team Image 1

3/13/2014

I. Background

The image displayed above is the photograph submitted for the first team assignment in Flow Visualization. The instructions were to work with a team to capture some sort of flow occurring. The phenomena which my team chose to photograph was the Marangoni effect. Silicone fluid with aluminum flakes was placed on a heating pad and cells were formed. Since the cells formed on their own, the main challenge was photographing the cells. I worked with Amanda Kennedy, Millie Blackstun, and Vigneshwaran Slevaraju.

II.Flow Apparatus

In order to create the cells visible in the image, we began with a heated plate. Silicone fluid laced with aluminum flakes was placed on the plate. The plate began to heat and as it heated convection occurred. Gravity began pulling the colder liquid from the top towards the hotter section on the bottom. As the plate got hotter an instability began to form, resulting in the formation of a cellular pattern. The depth of the fluid determined the cell size. In this case the fluid was about 1.5 cm deep. The machine itself was approximately 35 centimeters long. Figure 1 shows the set-up.

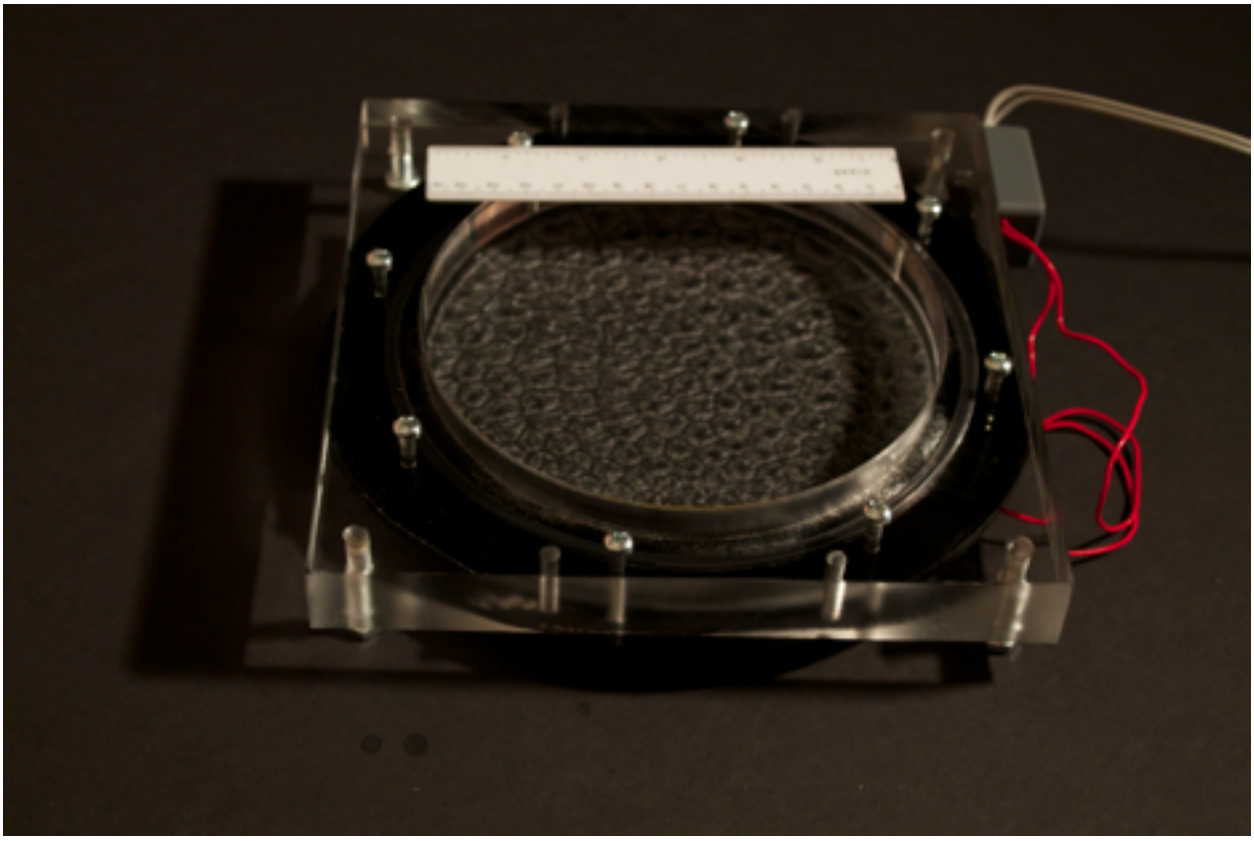

Figure 1

III.Visualization Technique

The convection resulted in the cellular patterns seen in the image. This is a natural effect of the processes occuring in the experiment. I did not disturb the fluid and instead let it settle. The plate was sitting flat so all of the cell sizes were fairly even.

For lighting I used an LED. The large LED was held slightly above and to the right of the image. It was held like this to avoid any reflections since the silicone fluid is highly reflexive. No other lights were used. An LED was used so the ISO could be lowered in order to get more detail and less noise in the image.

IV.Photographic Technique

Figure 2.

The camera used to record the flow was a Canon EOS Rebel T3. The focal length was 55 and the F stop was 5.6. Exposure was set at 1/25 of a second. The ISO was set at approximately 100 in order to allow for starker contrast between darks and lights, and to create the very black centers in the cells. I photographed the image at a slight angle. By angling the camera I was able to get a shallower depth of field.

Gimp was used to make changes to the image. The saturation was minimally increased to give the bright silver a red hue without altering the darker segments too much. The contrast was brought up, but it was marginal. I created a very small s-curve in the contrast box. The image was almost cropped to remove a small portion of black in the upper left corner. Figure 2 shows what the original image before any post-processing was done.

## V.Analysis

Overall the image turned out really well. It clearly demonstrates and showcases the Marangoni effect without drawing away from the physics. It has an artistic feel because of selective focus and color saturation. If I were to do the experiment over again I would experiment with different types of lights, but otherwise I have no complaints about the image.