

MCEN 4151
Flow Visualization
Team Second Report

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1 Introduction

The purpose of this image was to capture the interesting and beautiful flame phenomena using different colors of fire. Green and blue flames were chosen to really bring out the interesting and dynamic nature of a free burning substance. This project resulted in an artistic capture of a leaf burning in a mixture of methyl alcohol and boric acid. Having the right aesthetics is key to creating a powerful and visually pleasing image with fire. The static capture of these fast moving flames helps slow down time and really observe what is taking place in detail. Collaborated with Michael Lloyd, Joey Hall, and Schuyler Vandersluis to create flames and capture images.

2 Flow Apparatus

This experiment was conducted outside in a large, clear, and well ventilated area in order to observe safety considerations. A bucket of water was nearby in case the fire exhibited any abnormal behavior and a torch was used to ignite the mixture from a safe distance. The area chosen was blocked off from any outside light to ensure complete darkness surrounding the flames. Small amounts of methyl alcohol were poured onto a large section of pavement and then boric acid was sprinkled on top. Once ignited, these chemicals erupted into a beautiful mixture of blue and green fire. The blue comes from the burning of methyl alcohol while the green comes from the burning of boron molecules.

3 Visualization Technique

Creating the right scenario for the fiery mixture was no easy task. Due to the dynamic nature of fire, a small amount had to be used to produce a flame that could be fully captured with just a still image. Many different mixtures of methyl alcohol and boric acid were attempted to achieve the right amount of blue and green color. Once a good flame was produced, the team tried igniting it in different ways on the pavement. The easiest seemed to be a small puddle and allowed a nice controlled flame to exist enabling us to get close captures with the camera. Many different images were taken in order to capture all the beautiful colors and physics taking place. I choose to add

a leaf in the puddle to give my image a little extra artistic element and am very pleased with the results.

4 Photographic Technique

A Canon Rebel XS was used with an 18-55mm lens to capture this flame phenomena. Since the flame was approximately 5” wide, close shots were necessary in order to capture the full effect the flame gave off. To achieve this, a focal length of 51mm was chosen with this lens and the camera was positioned very close (a few inches) from the flame and leaf. This experiment took place outside in a dark and open environment to harness as much light from the flame as possible. Since the flame was exhibiting such fluid motion, an exposure time of 1/25 sec was chosen with an F-stop of f/5.6 and ISO of 800. Capturing pictures of fire proved to be very tricky. Since the flame is so dynamic, a short exposure time is needed to reduce motion blur but this creates the need for more light which is not available in these low light shots. Increasing the ISO and decreasing the F-stop value were essential to capture the flame. The only post processing was a slight change in the brightness and contrast completed in Photoshop and shown in Figure 1. The original untouched image is shown in Figure 2.

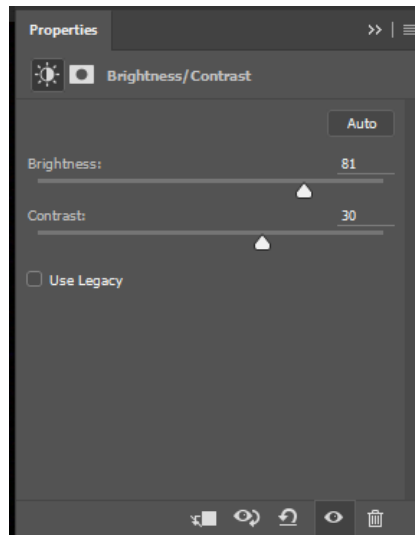


Figure 1: Contrast and brightness modifications made in Photoshop



Figure 2: Original untouched image

5 Conclusion

Capturing the interesting and beautiful phenomena of different color flames was achieved by igniting a mix of methyl alcohol and boric acid. Using the right mixture created amazing blue and green flames that are very dynamic in nature. These flames are clearly illustrated in the image and captured in a way that still preserves the physics taking place. A leaf was added to this burning mixture to give the photo a nice artistic touch which I found to be one of the most important elements of this image. Although capturing pictures of fire is tricky, the results are extremely rewarding. A larger flame in a larger environment could really enhance a future image of this nature as it would result in many more details of these dynamically moving flames.