From Plastic to Polyfill - Testing the Relationship Between Current and Temperature

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This project built upon last year’s research (2024-2025), testing the relationship between the final current (Cf) and the final temperature (Tf) of a cotton candy machine modified for plastic fiber production. For this study a long neck MLX90614 temperature sensor connected to an ESP32 computer system, which displayed temperature readings on an OLED ssd1306 display. The current was measured with a clamp-on ammeter. For the experiment, the machine was run at 9amps until it reached 500 degrees Fahrenheit, then the current was lowered to a second value which was the variable recorded as (Cf). After 4 minutes the final temperature (Tf) was recorded. The purpose of this experiment was to find an equation that could accurately predict a value that would keep the initial temperature of 500 and the final temperature equal and constant. A value within 5 degrees of the initial temperature after 4 minutes was considered constant. A regression test with a p-value of 1.60407 x 10^-11, showed a statistically significant positive relationship between the final current and final temperature. The research hypothesis stating that there would be a significant relationship between the final temperature and final current, was supported. The research hypothesis stating that the range of Cf values that kept the Tf constant would be within 6.5 to 7 amps was not supported. In conclusion, this process can be refined with more accurate sensors/tools to find a value where the temperature remains entirely constant in order to better melt the plastic.

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