THE HOT WIRE EXPERIMENT

Introduction

Among the most valuable skills of the scientist are the abilities to objectively observe phenomena and to accurately record them. Sometimes the phenomenon observed are obvious and perhaps not surprising while in other cases they may catch one completely off guard. The most interesting, and often the most important, observations may be the subtle ones. These are the ones that often hold the key to the solution of a problem, the clue that leads to new knowledge.

In this experiment a wire will be heated by passing a current through it. The objective is to observe and record all behaviors exhibited by the wire. This may sound like such a simple experiment, but there will be a few surprises and there are a lot of things going on at the same time. In order to fully appreciate the heating of a wire you will have to detect each of them. Hopefully, you will also be able to explain them.

Warning

Dangerously high voltages (115 VAC) and temperatures (900°C) are present during this demonstration. Be very careful when working with this equipment. Do not touch the bare wire when it is energized or when it is hot. Always turn off the power when changing the wire and stay clear while the unit is operating.

Procedure

Connect a straightened length of 24 gage iron or low-carbon steel wire across the terminals of the hot-wire fixture, hanging a small weight on the middle of the wire. Turn on the power supply (variac: 0-120 VAC, 10 amps) and gradually turn the power up to about 20% of full power. Note what happens to the wire. Gradually turn the power up to 45-50% of full power. The wire should now be glowing bright orange. After a few moments switch off the power and observe what happens to the wire. If possible, measure the behaviors you observe. Observations are not always qualitative.

Repeat this experiment again, varying the voltage and times as you see fit, but don't use the same wire more than three times. Replace it before it burns out. Also, try this experiment using other metals, such as copper, nichrome, aluminum or brass.

Results

Record your specific test (heating and cooling) procedures and your observations. Make sketches and take copious notes. Don't miss anything.

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Analysis

1. Make a list of each of the behaviors the wire demonstrated during the experiment.

2. Which of these would you attribute to the behavior of the wire and which do you think were caused by the experimental apparatus?

3. Of those you find to be due to the wire, which physical, chemical or mechanical properties do they demonstrate?

4. Are there any behaviors that you cannot explain? If so, how would you going about finding out more about them?