



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Harold F. Smith	Project Number S0514
Project Title Environmental Temperature Affects Crystal Formation in Bismuth	
Abstract Objectives/Goals Bismuth crystals have a very unusual shape; they appear terraced. My goal was to improve crystal "hopping" by slowing down crystal formation. Hypothesis: environmental temperature affects crystal formation in bismuth. Methods/Materials Several small chunks of bismuth were initially melted on the kitchen stove and allowed to freeze into the shape of a measuring cup at room temperature. The cup of bismuth was melted on a hot plate. The oxide layer was scraped aside and removed. The hot plate was then set to a temperature below 271°C. Crystallization time was recorded. Crystals were removed and quenched during the process. Temperatures assayed were: 35°C, 154°C, 183°C, 215°C, and 248°C. Each temperature was given three trials. Results Only three crystals formed at 215°C and none at all formed at 248°C. Below 215°C, once crystallization began, it continued until the bismuth froze solid. Thus, crystallization occurred for longer duration producing more crystals, the slower the bismuth cooled. In addition to the temperature effect, I observed four distinct crystal formations: hopper crystals, domed rectangles, spikes, and flat squares. Distinct forms grew in different trials. Rarely did different types form in the same batch. Conclusions/Discussion Temperature of the surroundings affects crystal formation. High temperatures inhibit growth. The data suggest that the environmental threshold for crystal formation is near 215°C. To narrow this down, more sophisticated equipment is needed. However the crystals formed at higher temperatures were not attractive. Really, the goal is to form beautiful hopper crystals. My new hypothesis is that crystal habit depends on the details of seeds in the oxide layer. Batches left heating for different amounts of time had different oxide layers and different crystal habit. I believe these are correlated.	
Summary Statement This project is about the affect of environmental temperature on crystal formation in bismuth.	
Help Received My parents helped me obtain the supplies I needed for this project.	