



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Albert G. Linden	Project Number S1513
Project Title The Effect of Ammonia Gas on Copper Nanowire Sensors	
Abstract Objectives/Goals The objective of this experiment was to expose copper nanowire arrays to ammonia gas and measure the change in resistance of the arrays upon exposure and for some time thereafter. Methods/Materials Materials: CuSO ₄ H ₂ SO ₄ H ₂ O Na ₂ SO ₄ Fume hood Sterile glass slides Electrochemistry array Pressurized tanks of ammonia and nitrogen HOPG Graphite Silver paste Cyanoacrylate glue Current amplifier Multimeter system Computer with a multimeter program 50 mL vial Methods: I grew copper nanowire arrays from a solution and tested their change in resistance when exposed to ammonia for 5 seconds. With no ammonia, the resistance of copper nanowires does not change, while the presence of ammonia causes an increase in the resistance of the arrays. I used 2 different copper nanowire arrays and took 7 sample readings from each one. I measured the resistance of the nanowire arrays before, during, and after their exposure to ammonia and compared this to the initial resistance of the array with a ratio. Results My data had a mean resistance increase of 35.5% and were highly variable with a minimum of 8% and a maximum of 105% increases in resistance, excluding one outlier of 301%. Conclusions/Discussion The presence of ammonia causes a significant increase in the resistance of copper nanowire arrays. This effect is always noticeable but the magnitude of the change is subject to large variation.	
Summary Statement My project measured the change in resistance of copper nanowire arrays when exposed to ammonia gas for future application as ultrasensitive gas sensors.	
Help Received My mother helped make the backboard and I used lab equipment at the University of California, Irvine under the supervision of Dr. Reginald Penner.	