



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Mikael H. Matossian	Project Number S0514
Project Title Plasma Treatment of Automotive Engine Exhaust	
Objectives/Goals The objective of my science project was to use a plasma discharge to modify the Nitrogen Dioxide (NO ₂), Nitrogen Monoxide (NO), Carbon Monoxide (CO), and Hydrocarbon (HC) composition of automotive exhaust gas. My hypothesis is that since plasmas use high-voltage electric fields to ionize, dissociate, or modify gases into different species, it should be very effective in modifying the composition of automotive exhaust gas and may have advantages over conventional catalytic converters.	
Abstract	
Methods/Materials MATERIALS <ul style="list-style-type: none">- Plasma created by high-voltage plasma generator- Automotive exhaust simulated by radio-controlled (RC) nitromethane car- RAE colorimetric gas detection tubes METHODS <ol style="list-style-type: none">1. Plasma production kept constant during all tests.2. Automotive exhaust gas flow rate kept constant by stable operation of RC car.3. Gas concentraion levels measured 3 times for stability and reproducibility.	
Results <ol style="list-style-type: none">1. Plasma treatment of nitromethane exhaust was very effective in reducing the the two most noxious components (CO and NO) to non-measureable levels.<ul style="list-style-type: none">- Specifically, plasma treatment reduced the CO and NO concentration levels by over a factor of 40.2. Plasma treatment of nitromethane exhaust increased the NO₂ and HC concentration levels.<ul style="list-style-type: none">- Specifically, plasma treatment increased the NO₂ concentration levels by factor of 80 and the HC concentration levels by a factor of 4.	
Conclusions/Discussion <p>Plasma treatment is a non-thermodynamic technique that can effectively modify the chemical compositions of exhaust gases. Nitromethane exhaust, which has similiar composition to actual automotive engine exhaust, is comprised of CO and NO, as well as NO₂ and HC's. Plasma treatment reduced the concentrations of CO and NO to non-measurable levels. In contrast, it increased the concentrations of NO₂ and HC's. Plasma treatment could be used in conjunction with conventional catalytic converters to improve conversion of toxic exhaust gases into more benign species.</p>	
Summary Statement <p>Plasma treatment of automotive engine exhaust can eliminate NO and CO emissions to non-measureable levels.</p>	
Help Received <ol style="list-style-type: none">1. Professor Antonio Machado (CSUN) helped me understand the various chemical reactions in nitromethane fuel exhaust. Father helped with assembly of the high-voltage plasma generator.	