# CALIFORNIA STATE SCIENCE FAIR
# 2011 PROJECT SUMMARY

**Name(s)**

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**Project Number**

**S0601**

**Project Title**

## Investigation of Polydimethylsiloxane as a Solid Media for Fluorophores at Room Temperature

**Abstract**

**Objectives/Goals**

The goal of this project is to investigate the propensity of polydimethylsiloxane (PDMS) to absorb different fluorescent dyes, coumarin 151 (C-151) and N-phenyl-4-dimethylamino-1,8-naphthalimide (Ph-ANI). The doping of PDMS with dyes allowed us to study their photophysical properties in solid matrix at room temperature which is relevant for the design and engineering of polymer devices. We used ethanol and dichloromethane solutions of dyes to dope polymer and employed UV/Visible absorption spectroscopy, and steady-state and time-resolved emission spectroscopy for photophysical studies.

**Methods/Materials**

I fabricated the PDMS slabs by mixing PDMS prepolymer with curing agent (10:1), degassing the mixture under vacuum and pouring it into molds. Upon curing, PDMS turned into transparent elastic material. I removed PDMS slabs and blocks from the molds and cut into shapes required. Concurrently, I synthesized a nonpolar dye, N-Phenyl-4-dimethylamino-1, 8-naphthalimide (Ph-ANI) via a procedure developed in our lab. For comparative studies, I used commercial available dye, Coumarin 151. I made dye solutions with different concentrations in ethanol and dichloromethane (DCM). I soaked PDMS slabs in dye solutions. The solvents swelled PDMS, allowing the dye to diffuse into interior of polymer slabs. After washing and applying vacuum, the PDMS slabs returned to their original sizes and exhibited color and fluorescence inherent to the dye with which they were doped. I used absorption and emission spectroscopy to characterize the photophysical properties of PDMS-dye samples.

**Results**

The absorption and fluorescence spectra of dyes in PDMS were different from the spectra of the dyes in organic solvents. The absorbance revealed that DCM allowed for superior doping of the PDMS with both dyes. The fluorescence lifetimes of the dyes, obtained from single photon counting measurements, manifested small variations between the solvent and PDMS sample, indicating that the polymer environment did not dramatically perturb photophysical properties of fluorophores.

**Conclusions/Discussion**

We successfully demonstrated a facile method for doping PDMS with fluorescent agents. Spectroscopy studies confirmed the doping of the polymer and integrity of the dyes intercalated in the polymer environment. This method for introducing chromophores in optically transparent polymer materials will have important implications for photonics engineering.

**Summary Statement**

We demonstrated a facile and straightforward method for doping polymers with optically active agents, such as fluorescent dyes, and used UV/visible spectroscopy to confirm the feasibility of our approach.

**Help Received**

Dr. Val Vullev, Professor of Bioengineering and Duoduo Bao, Ph.D Candidate at UC Riverside supervised this project and helped me use the equipment supplied in the lab.