



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

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| Name(s) Roshan J. Plamthottam | Project Number S1898 |
| Project Title The Self-Assembly of Diamagnetic Materials Using a Magnetic Field | |
| Abstract Objectives/Goals My project was to determine if macro, micro, and nano scale diamagnetic materials can be self-assembled into three-dimensional structures using a magnetic field in a superparamagnetic medium. I believe that the nano-scale and macro-scale beads will not self-assemble due to issues arising from the size of the beads relative to the size of the particles in the medium. Methods/Materials After synthesizing super-paramagnetic nano-particles, 1 μ m, 2 μ m, 15 μ m, 25 μ m, and 1/16" polystyrene and acrylic beads were placed in microscope filter holders by size along with a diluted solution of the nano-particles. Each sample was placed under a strong magnetic field for at least two hours before being observed under a microscope, in order to visually examine any structures that may have formed. The procedure was carried out three times to ensure accuracy and to obtain reliable and sufficient data. Results The 1 μ m, 2 μ m, and 1/16" beads did not self-assemble into structures when examined under an optical microscope. However, the 15 μ m and 25 μ m polystyrene beads did self-assemble into various ordered structures. Conclusions/Discussion It was determined that the 15 μ m and the 25 μ m polystyrene beads can be self-assembled using a magnetic field in a superparamagnetic medium, despite the bead's diamagnetic properties. Similar processes can be employed for applications in fields such as chemistry, medicine, and photonics as well as others. Conditions must be met before self-assembly can occur, and the superparamagnetic medium allows certain sized diamagnetic materials to self assemble. | |
| Summary Statement My project was to determine if macro, micro and nano scale polystyrene and acrylic beads will self-assemble under a magnetic field when placed in a superparamagnetic medium. | |
| Help Received Used lab equipment at Sebastian Scientific Corporation under the supervision of Dr. Plamthottam | |