CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
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Project Number
S0621

Project Title
Characterization of Biomedical Graphene

Abstract

Objectives/Goals
My project tested for three properties--diffusion, structural integrity, and coefficient of friction--in graphene to determine whether it is a viable material for biomedical engineering. The objective was to utilize graphene's properties as a material for tissue engineering or prosthetics.

Methods/Materials
Important materials for this project included multi-layered graphene, a side-by-side diffusion cell, a small pulley, and various solutions. My experiment was broken up into three test, each for a separate property of a biomedical material. I used the diffusion cell to calculate graphene's permeability and rate of diffusion, and I calculated graphene's friction coefficient using a simple pulley system. Material durability was tested in a 10 percent acetic acid solution.

Results
The diffusion test showed that graphene is an impermeable membrane because it did not diffuse ions in solution. However, the material is more durable that metals and alloys as demonstrated by the durability test in acetic acid. Furthermore, Graphene has a low coefficient of friction, comparable to that of synovial fluid in humans.

Conclusions/Discussion
Graphene is a viable material for biomedical engineering. Based on the results, it is stronger than most metals and alloys; further research projects a graphene-based material capable of diffusing ions across a barrier. The tribological interactions between sheets of graphene successfully resemble those of synovial fluid in human joints. A porous graphene may be most compatible in the human body when it is engineered within a composite structure of cell tissue.

Summary Statement
This project characterized graphene and demonstrated its viability as a biomedical material.

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