CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34975

Project Title

A Study of Levitation Distance and Stability Range in Diamagnetic Levitation

Abstract

Objectives/Goals

This project studies how ferromagnetic and diamagnetic forces affect magnetic levitation distance and its stability, respectively in diamagnetic levitation.

Methods/Materials

Materials used include neodymium magnets N42/52 with different strength, weight and geometry as lifter and levitator; pyrolytic graphite plates with different strength providing levitation stability. A novel apparatus is built to carry out experiments in which vertical position of magnet and pyrolytic graphite plates can be continuously adjusted. Ruler stickers with both metric and English units for precise measurements are attached.

Levitation distance and stability range are measured when altering controlled variables like lifter and levitator magnet pull force, levitated magnet weight, pyrolytic graphite strength and environmental temperature. Each data point is the average of 5 repeated measurements to further improve the accuracy.

Results

Levitation distance increases with stronger lifter magnet or less weighted levitator. Stronger pyrolytic graphite plate, but not more plate counts, increases stability range of the levitation. Magnet pole facing has no impact on levitation distance and stability range. Higher temperature weakens ferromagnet strength, therefore decreases levitation distance, while no impact to stability range.

Conclusions/Discussion

Magnet can be stably levitated with assistance of diamagnetism. Magnet is levitated when magnetic force and gravity force are balanced. Hypotheses stating that longer levitation distance can be achieved by either stronger lifter magnet or less weight of levitator magnet are supported by data. On the other hand, stronger diamagnetic material creates a larger stability range due to its increased repelling force. However, the statement of more stacked diamagnetic plates creating a larger stability range is not supported by data. This is because diamagnetism (repelling effect) only happens on the surface of the diamagnetic material based on further study. Heat impact magnetic strength, therefore levitation distance, but not diamagnetic strength, so no stability range change observed. The project can be expanded using electromagnet and electronic system.

Summary Statement

This project studies how ferromagnetic and diamagnetic forces affect magnetic levitation distance and its stability, respectively in diamagnetic levitation.

Help Received

Father helped ordering magnets. Dr. Li gave useful advice.