CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)

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Project Number

J1524

Project Title

Tribo-Light AM: Continuous Triboluminescence and Radio Emission from a Safe, Portable, Low-Cost Generator

Abstract

Objectives/Goals

Develop a low-cost, safe, portable, classroom-friendly continuous triboluminescence generator to study the physical properties of this phenomenon.

Methods/Materials

Sucrose and Wint-O-Green Lifesavers both emit brief flashes when struck/ground, but only peeling adhesive tape emits continuous triboluminescence visible in a dark room. Three tape-based generator versions # manual hand-crank, electric eggbeater, and Lego-based # were constructed. A super low-lux CCD camera was used for live viewing/recording. Sound and radio signals were recorded using a portable microphone and radio connected to a laptop computer to determine whether the tape produced radio emission. Linear filters were used to detect polarization. The spectrum of the light was captured using a quantitative spectroscope and compared with the published spectrum of nitrogen.

Results

Continuous triboluminescence is emitted with partial polarization at the unwinding end and, surprisingly, flashes were emitted at the rewinding end also. Color photos and video of the light were captured. Fairly strong radio emission was detected. The spectrum was similar to nitrogen.

Conclusions/Discussion

Peeling tape is the safest, cheapest, and most portable method for generating and studying the properties of triboluminescence. The hand-crank version is cheapest and best for photography and recording sound and radio emissions but requires a dark room and manual effort. The eggbeater version is inexpensive and effortless but too fast. The Lego version has programmable speed control and is a portable and safe way to generate triboluminescence in classrooms, but is more expensive. Visible light was recorded continuously at the unwinding end and appears to be partially polarized. Light flashes were recorded at the rewinding end and all over the tape. Spectral analysis proves that emission is due to fluorescence of nitrogen. Fairly strong radio emissions were recorded at normal atmospheric pressure between 1100 and 1500 KHz. Sound, light and radio emissions are time-correlated.

Summary Statement

Developed safe, low-cost, portable continuous triboluminescence generators using adhesive tape and analyzed properties of the energy emitted.

Help Received

Dr. Carlos Camara (UCLA) showed tape based x-ray emission that inspired me to use tape. My family and advisor helped me understand concepts, plan board, edit report, and purchase materials.