CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Ray Ramirez

Project Number
S1518

Project Title
Wavelength Controlled Holographic Polarization

Abstract

Objectives/Goals
The project had two objectives. The primary objective was to design an optical system that polarized light based on the selective subtraction theory. The optical system would be designed in such a way as to serve as a platform to record polarizing holographic optical elements. The second objective was to chemically manipulate the holographic optical element in such a way as to selectively polarize specific wavelengths of light, while scattering or absorbing all others.

Methods/Materials
To accomplish the first objective, a glass-plate polarizer was constructed. The optical system consisted of standard holographic recording materials, including an isolated platform, optical mounts, a helium-neon laser, processing chemistry and a high resolution silver-halide holographic emulsion on polymer and glass substrates.

Results
The desired optical system was designed using a method known as selective subtraction via a glass-plate polarizer. Based on Brewsters theory of reflection, this polarizer systematically eliminated light of undesired polarization. The second objective was achieved by preswelling the holographic emulsion in a process known as presensitization. This technique utilizes the chemical triethanolomine (TEA), which is absorbed into the emulsion and later determines the reconstruction frequency of the holographic optical element.

Conclusions/Discussion
It was determined that the experimental methods utilized were an innovative and effective way to selectively polarize light, based on its initial wavelength and state of polarization. The polarizing holographic optical elements performed comparably with current polarizing technology.

Summary Statement
A holographic polarizer was produced that selectivley polarizes light based on its initial state of polarization and wavelength.

Help Received
Mr. Fred Unterseher, Columbia Career Center, Columbia Missouri.