Nematic Liquid Crystalline Order
Ahlawat, Aditya; Doyle, Robert; Mongeau, Jennifer; Mulken, Brian; Ogilvie, Alex* and Georgiev, Georgi

ABSTRACT

Topological defects formed during phase transitions in liquid crystals (T.1) are interesting and important to study, because they can provide insights into the structure and behavior of these materials. The approach is a variation of background and the formation of the observed large scale galactic structure of the Universe. Cosmic strings decay into liquid crystalline state of the nanotubes, either in their lyotropic phase or in combination with organic liquid crystals. Later we implemented this design, manufacturing it from the material aluminum at the machine shop at the Worcester Polytechnic Institute. We are measuring the ellipse perpendicular to the sample and using this method to study the order in liquid crystals. The reason for choosing polarized light ellipsometry to study the order in liquid crystals is because it is extremely fast and powerful tool for measuring the amount of refraction that takes place when the EM wave is crossing the boundary between two different media. It is defined by \( n = c/v \), where \( c \) is the speed of light in vacuum and \( v \) is the velocity of the light in the medium. The Stokes vector represents the intensities of the four quantities, which are the time dependent components of the electric field vector of the light in x and y direction. The coordinate system \( z \)-axis, \( y \)-axis, \( x \)-axis, and \( z \)-axis are the time dependent components of the light field, respectively. The Stokes vector is a four-dimensional vector that describes the polarization state of a light field. The Stokes vector is given by:

\[
\begin{align*}
S_1 &= E_x \cos \theta - E_y \sin \theta \\
S_2 &= E_x \sin \theta + E_y \cos \theta \\
S_3 &= E_x \sin \omega - E_y \cos \omega \\
S_4 &= E_x \cos \omega + E_y \sin \omega
\end{align*}
\]

The Stokes vector parameters represent intensities.

\begin{itemize}
  \item \( S_1 \): Linearly polarized light
  \item \( S_2 \): Circularly polarized light
  \item \( S_3 \): Elliptically polarized light
  \item \( S_4 \): Linearly polarized light
\end{itemize}

RESULTS AND CONCLUSIONS

Design We have tested a novel simplified design of a polarized light ellipsometer (Fig. 6) based on a simple quarter wave plate and polarizer. This design is a significant improvement from a previous version of it, which required using electrically controlled sample shells for changing the elliptically polarized state of the light.\(^{\text{14}}\)

Calculations Using Stokes analysis we have derived the mean form of the optical elements under conditions of change in their properties (Eqs. 1-3). Using these expressions we have found novel solutions for the plane shear and angular state of the polarized light at each point of the sample using for visual tamper different in polarized conditions.

THE FIELD

Two dimensional optical Ellipsometry, a division of light polarized microscopy

While the report on exchange of optical Ellipsometry, which provides quickly and properly resolved structural information across the field of the imaging. The approach is a variation of background and the formation of the observed large scale galactic structure of the Universe. Cosmic strings decay into liquid crystalline state of the nanotubes, either in their lyotropic phase or in combination with organic liquid crystals. Later we implemented this design, manufacturing it from the material aluminum at the machine shop at the Worcester Polytechnic Institute. We are measuring the ellipse perpendicular to the sample and using this method to study the order in liquid crystals. The reason for choosing polarized light ellipsometry to study the order in liquid crystals is because it is extremely fast and powerful tool for measuring the amount of refraction that takes place when the EM wave is crossing the boundary between two different media. It is defined by \( n = c/v \), where \( c \) is the speed of light in vacuum and \( v \) is the velocity of the light in the medium. The Stokes vector represents the intensities of the four quantities, which are the time dependent components of the electric field vector of the light in x and y direction. The coordinate system \( z \)-axis, \( y \)-axis, \( x \)-axis, and \( z \)-axis are the time dependent components of the light field, respectively. The Stokes vector is a four-dimensional vector that describes the polarization state of a light field. The Stokes vector is given by:

\[
\begin{align*}
S_1 &= E_x \cos \theta - E_y \sin \theta \\
S_2 &= E_x \sin \theta + E_y \cos \theta \\
S_3 &= E_x \sin \omega - E_y \cos \omega \\
S_4 &= E_x \cos \omega + E_y \sin \omega
\end{align*}
\]

The Stokes vector parameters represent intensities.

\begin{itemize}
  \item \( S_1 \): Linearly polarized light
  \item \( S_2 \): Circularly polarized light
  \item \( S_3 \): Elliptically polarized light
  \item \( S_4 \): Linearly polarized light
\end{itemize}

BIBLIOGRAPHY

1. 
2. 
3. 
4. 

ACKNOWLEDGMENTS

Special thanks to Prof. Sholes, Prof. Slavkovsky and Prof. Theroux who contributed to this research with their full support and useful discussions.