PHOTOELASTICITY: DIY POLARISCOPE.

BY: ALEJANDRO ARIEL GARCÍA ARRIAGA
COACALCO DE BERRIOZÁBAL ESTADO DE MÉXICO, MÉXICO

Introduction:

Last month I presented an article about a DIY polarizing microscope that I created using my compound microscope and a pair of polarizing filters taken from an old cell phone and old calculator. The results were amazing and comparable to those made with a real polarizing microscope.

I used two methods, one placing the analyzer filter between the eyepieces and the objectives and the other by placing the analyzer directly upon the sample beneath the objectives, both worked very well. I mention this because the second method is based on the principle that follows the use of a polariscope, which is a device that can be used to see the polarization properties of birefringent materials. Typically the device consists of a source of light covered with a polarizing filter and a space to place the object to analyze and then another polarizing filter that fills the field of view. With this kind of device you can see the photoelasticity, first described by the physicist David Brewster.

I*mage taken from https://www.prlog.org/12474100-polariscope-strain-viewer-for-preform.jpg for educational purposes to illustrate what a polariscope looks like.*

Development:

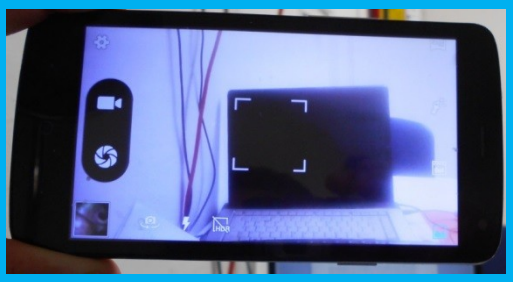
Photoelasticity is a very simple concept to understand; it is the technique used to see the points of stress of an object and where the most likely breaking points are. It uses the properties of certain materials to show birefringence, the more colors that appear the more breakable that point is.

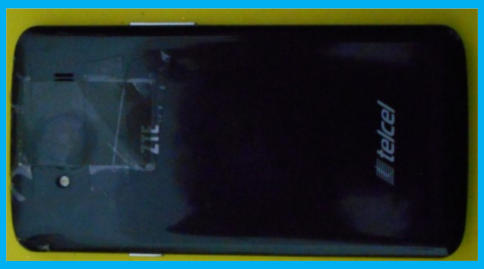
In case that the material does not exhibit birefringence, it is possible to cover the material with another one that adheres to the surface and that does exhibit anisotropic properties. This way the second material exhibits the breakable points of the first one if there are any obvious.

It is not so easy to find a polariscope but it is easy to create one on a DIY basis and see the photoelasticity of many objects that we can find around us (see below).

My polariscope is made of three objects; my laptop that works as the polarized source of light, a piece of polarizing filter that can be taken from any LCD display available and a cell phone with a camera.

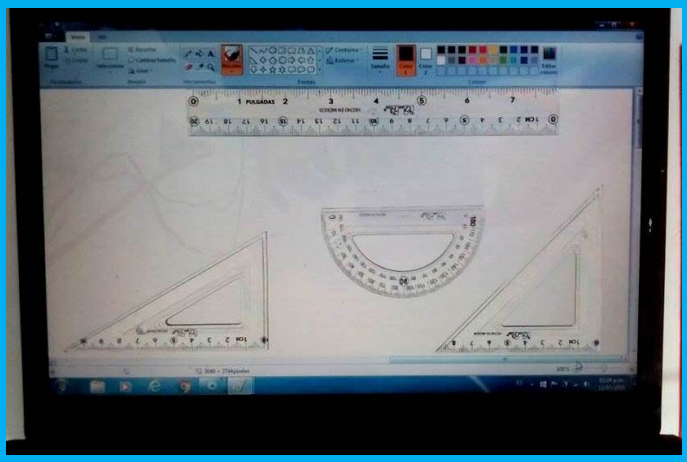
With the laptop on and watching through the screen of the cellphone, place the filter upon the lens of the cell phone camera and adjust it until it covers the field of the laptop. Rotate it until the filters are 'crossed' which should appear as a black screen. Secure it with transparent tape.





Then on the laptop open a white page, it should be a white page because if you use another color, since the birefringent object is going to fill the field, you will have a part of the colors caused by the photoelasticity showing as the color of the background and it is going to distort the result.

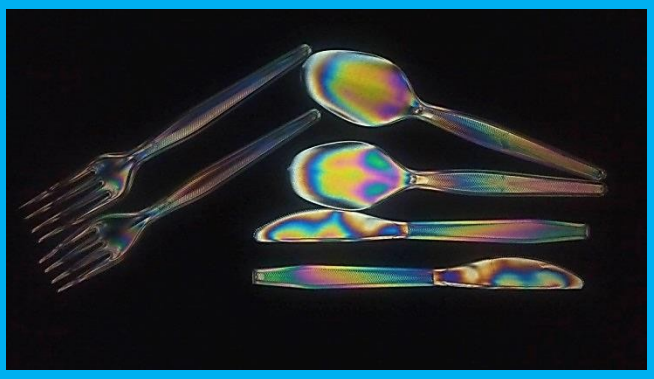
I opened for my experiment a window of the program *Paint* and



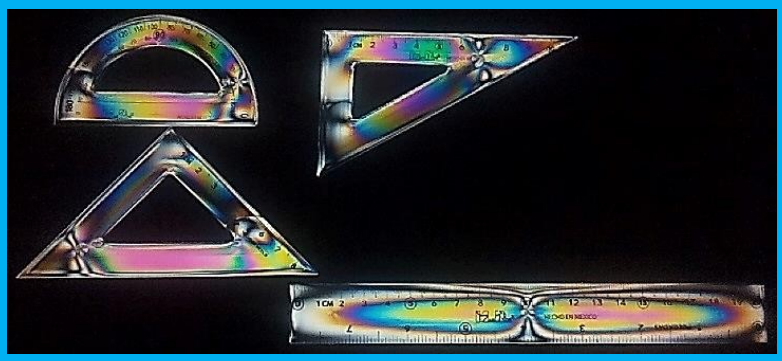
turned my laptop upside down and placed the objects in the middle of the screen.

Then after turning off the lights of the room and with the help of the cellphone with the filter, I cover the field of view.

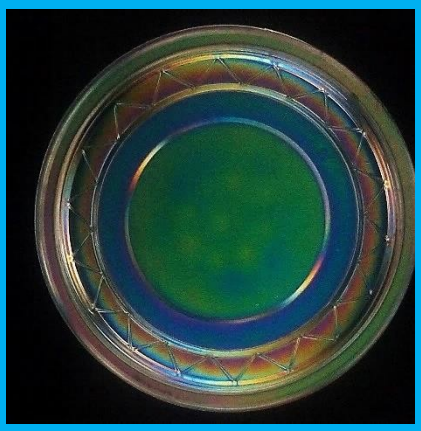
Results:



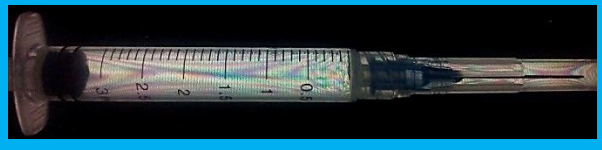
Plastic transparent cutlery



Geometry set



The cover of a disposable bottle



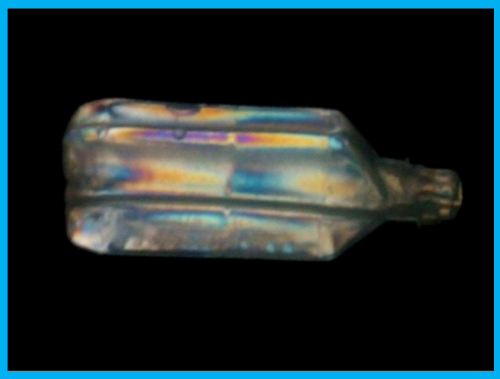
A complete syringe

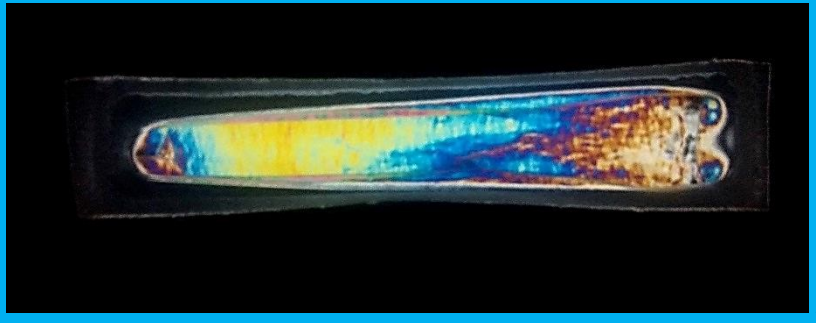
Tape dispenser

Optical fiber threads

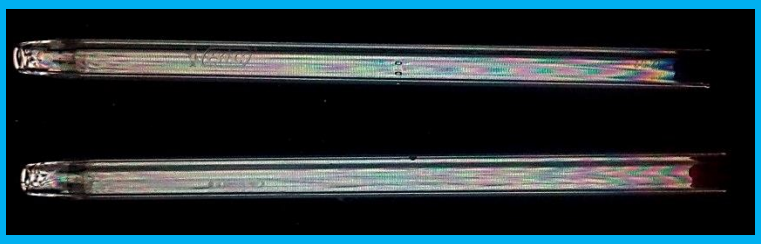
A plunger of a syringe

An injectable water container

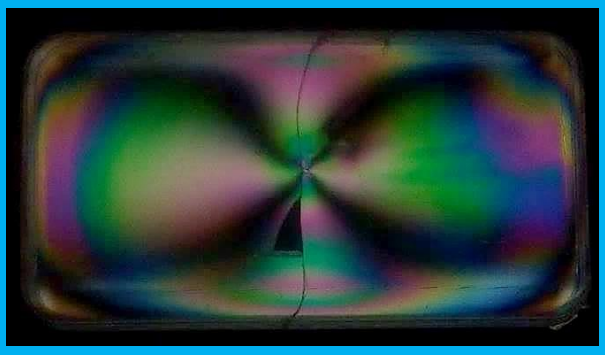




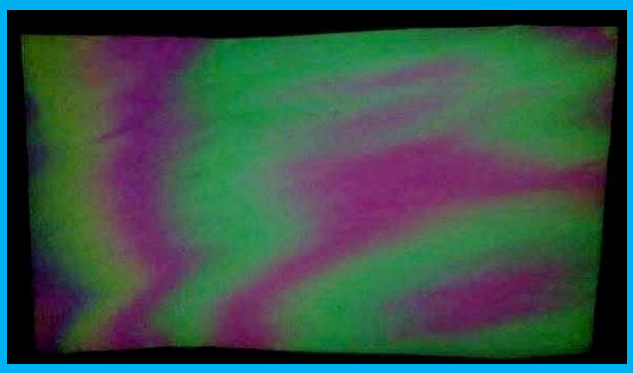
A package of a syringe



A pair of pens



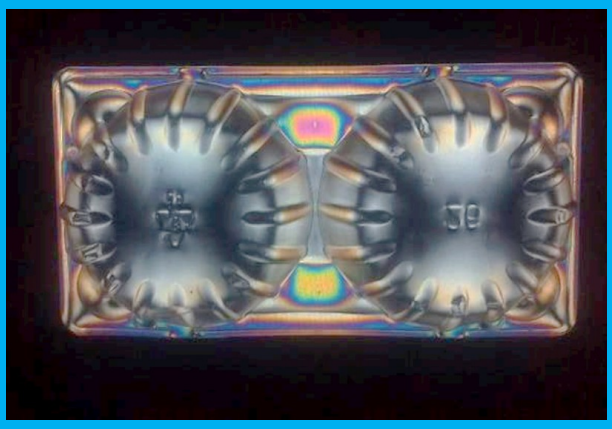
The cover of a plastic box



A bit of an acetate sheet

An led

A plastic container




A pair of glasses


A bit of cellophane

Conclusion:

There are many objects around us that show photoelasticity both in the macro and the micro worlds, studying them is easy in a DIY form.

Email author: doctor2408 AT yahoo DOT com DOT mx

(Above in anti-spam format. Copy string to email software, remove spaces and manually insert the capitalised characters.)

Published in the April 2016 issue of *Micscape* Magazine.

www.micscape.org