

## Introduction

Photopolymers are a class of optics that utilise nanoparticles of varying sizes to scatter light as it interacts with the material. This contrasts with conventional optics which rely on refraction to bend light. The size and concentration of specific nanoparticles in a material allow for alteration of the properties of the light interacting with them. Specific concentrations of nanoparticles can capture the phase and polarisation of the light and re-emit it with high levels of accuracy.

## Tasks undertaken

- Spin coating
- Drop casting
- Hardness testing
- Refractive index measurement
- Hologram creation

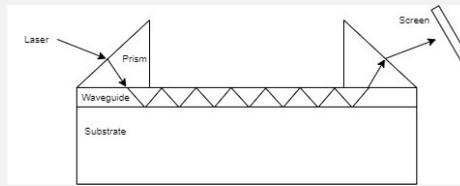


Figure 1 - Diagram of refractive index measurement using refractometer.

## Difficulties encountered

### Sensitive equipment.

- Required repeats of experiment.
- Environmental interference could affect results

### Time restraints

- Only 4 weeks to preform experiments and gather data

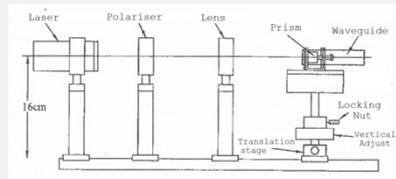


Figure 2 - Refractometer setup [1]

## Results

The RIM was found to have a peak modulation at 0.25% concentration using a 5mW laser, with a value of  $0.0259 \pm 0.000438$ . (Seen in Figure 5)

Bragg grating efficiency (as shown in figure 6) shows the peak efficiency was found at 0.25% GQD concentration.

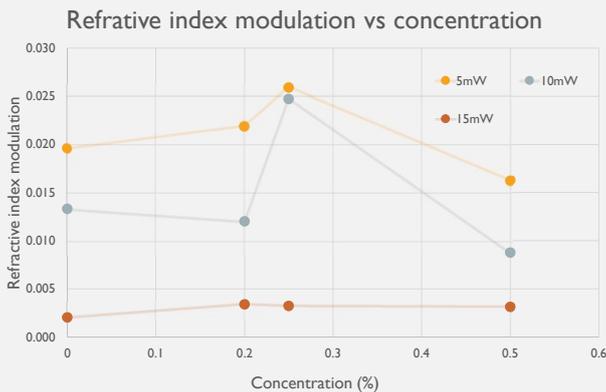


Figure 5 – RIM comparison

## Experimentation

Spin coating was done to on a G3P spincoater in order to create smooth layers for testing, these were found to be too thin for hologram creation however.

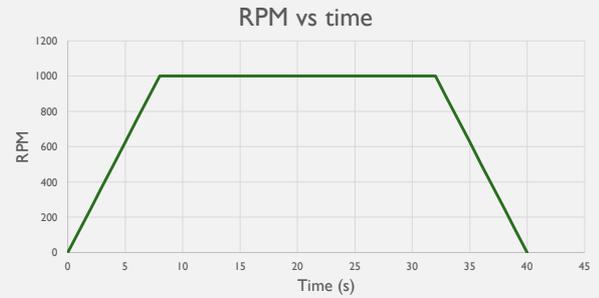


Figure 3 – diagram of spin coater recipe

Drop casting was done to create thicker layer to create holograms on.



Figure 4 - Drop cast slides (left) vs Spincoated slides (right)

## Age of slides

Before holograms were created a new batch of slides were created with the old slide having rested for 60 hours, and the young slides having rested for 6 hours.

## Conclusions

The goal of this research was to understand the effect of graphene quantum dots on the optical effects of photopolymer layers.

It is clear to see that GQD's are a viable alternative to conventional optics, and that they efficiently change optical properties, even when used in low quantities.

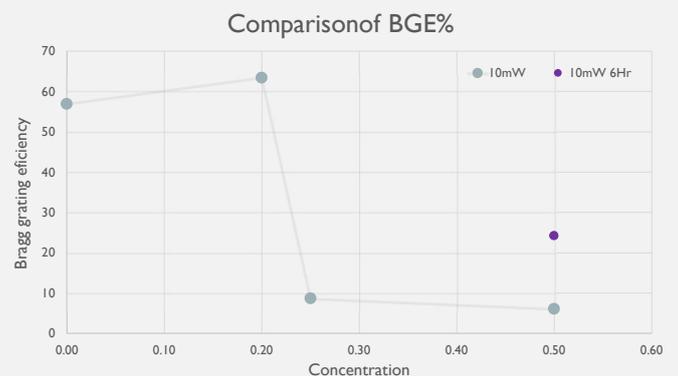


Figure 6 – BGE% for young and old slides