Strathclyde Chemistry II
Light Emitting Polymer Films and Blends

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Basic Technology Research Programme — RESEARCH COUNCILS UK — *A 1000 micro-emitters per square millimetre*

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1. HTP(1-4) AS LEP HOST OR INERT LAYER MATERIALS

- LEP materials are intrinsically immiscible with glycidyl ether containing systems as shown in figure 1(a)
- The glycidyl ether systems are therefore, ideal for creating LEP/inert layered systems figure 1(b)
- Due to a mixture of a number of glycidyl ether containing systems, we are able to vary viscosity, glass transition cross link density and to some degree refractive index
- Vinyl ether containing systems figure 2 have been found to be excellent host materials for forming miscible blends of transparent polymer/LEP blend figure 1(c).

Figure 1 a) PFO/HTP2 immiscible blend, b) RedF/HTP2 over layer and c) PFO/HTP3 miscible blend

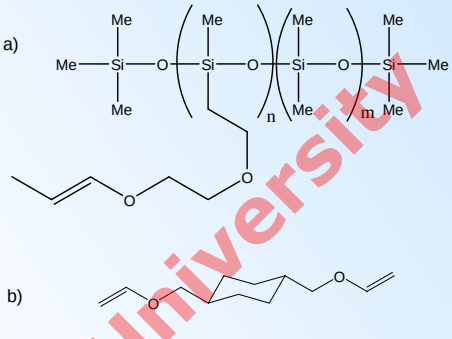
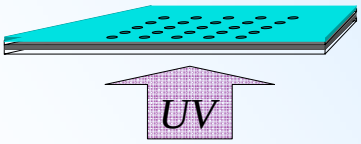


Figure 2 a) Vinyl Ether functionalised PDMS (HTP4)
b) Vinyl Ether based cyclo aliphatic (HTP3)

2. Aperture formed LEP lenses

- The LEP/HTP3 blend forms lens structures by using an aperture as shown in figure 3
- The blend in liquid form is deposited on the glass slide over aperture of between 50-150 micron
- The uncured material after exposure is washed off (developed), shown in different colours in figure 4
- The absorption characteristics and structures of the (a) photo acid and (b) blue LEP are shown in figure 5
- The LEP/HTP3 miscible blend allows the formation of LEP structures using standard lithographic techniques the profile of the lens is shown by dektak in figure 6



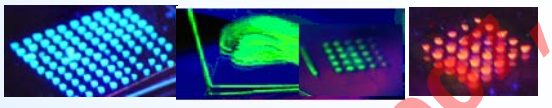


Figure 4. LEP/HTP3 lenses formed using aperture control PFO (blue), F8BT (green) and RedF (red)

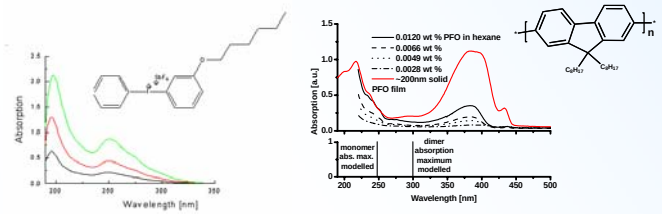


Figure 5 Absorption and structure of (a) Photo acid Generator (b) PFO LEP

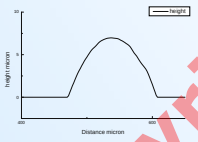


Figure 6. Dektak profile of aperture formed lenses

3. DIRECT WRITING OF LEP/HTP3 BLENDS

- HTP3/blueLEP blend aligned on micro stripe LED, figure 7
- Cure time on LED <1second on lowest power
- This cure time is still too long causing poor resolution
- However, the LED is a 368nm and the vinyl system does not cure above 320nm ?

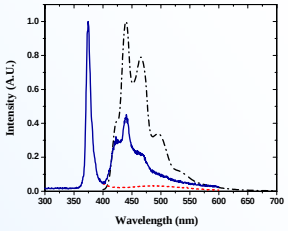


Figure 8. Emission characteristics of LED, LEP and LEP blend

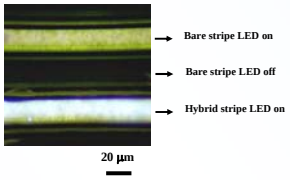
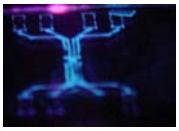


Figure 7. Micro strip LED with LEP blend integrated on single stripe

- The HTP/LEP blend has been tested using HW He/Cd 325nm laser
- The figure shows the structure illuminated over the stripe LED device figure 9
- Two stripes were illuminated in this case
- The test involved writing the structure at 10000 micron/sec resulting in a highly resolved structure although this is limited to the speed of the laser writing stage and not the polymer kinetics

Figure 9. Micro fluidics structure created in under 20 seconds



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