Supplementary Material (ESI) for Lab on a Chip


# SUPPLEMENTARY INFORMATION

## Novel Multifunctional Materials Based on Ionic Liquids: on Demand Light Micro Valve Actuation for Lab-on-a-Chip Applications

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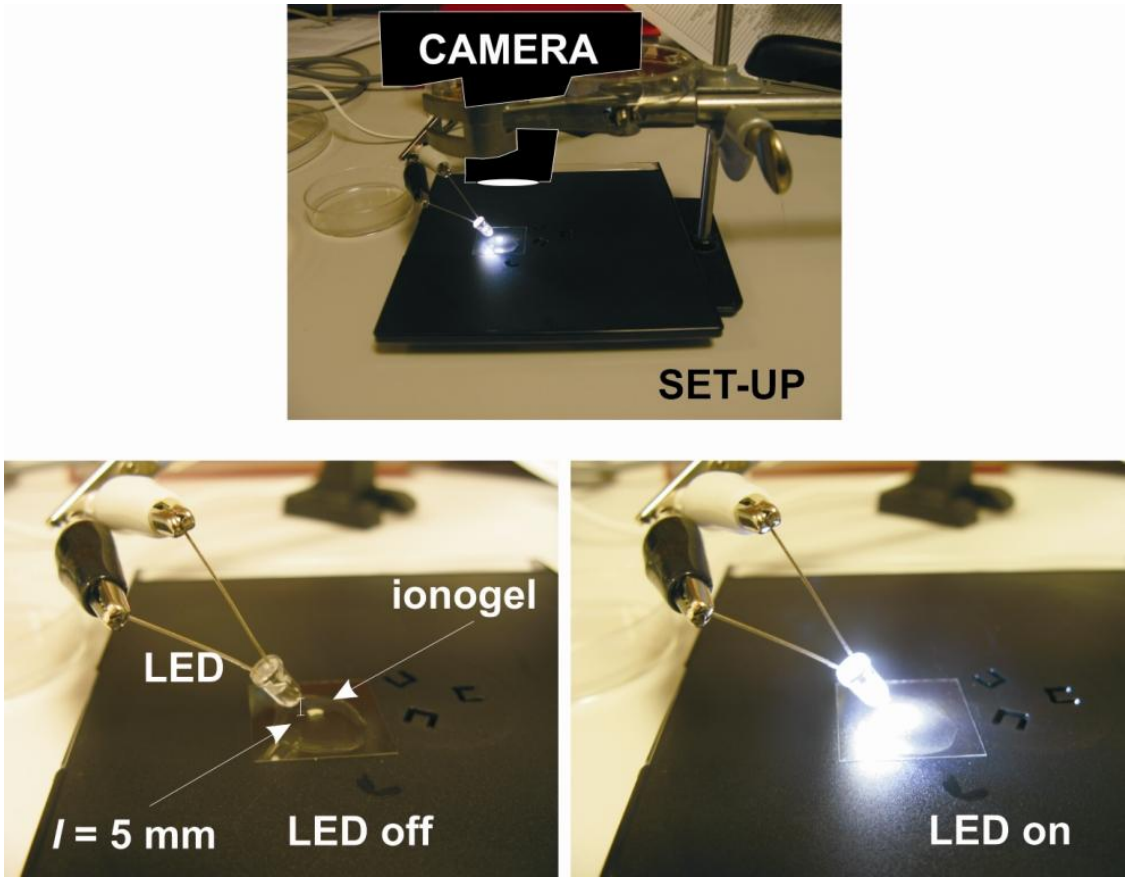
- VIDEO.1: Shrinking process of $[dca]^-$ ionogel under white light irradiation. Similar shrinking behaviour was observed for the other ionogels.

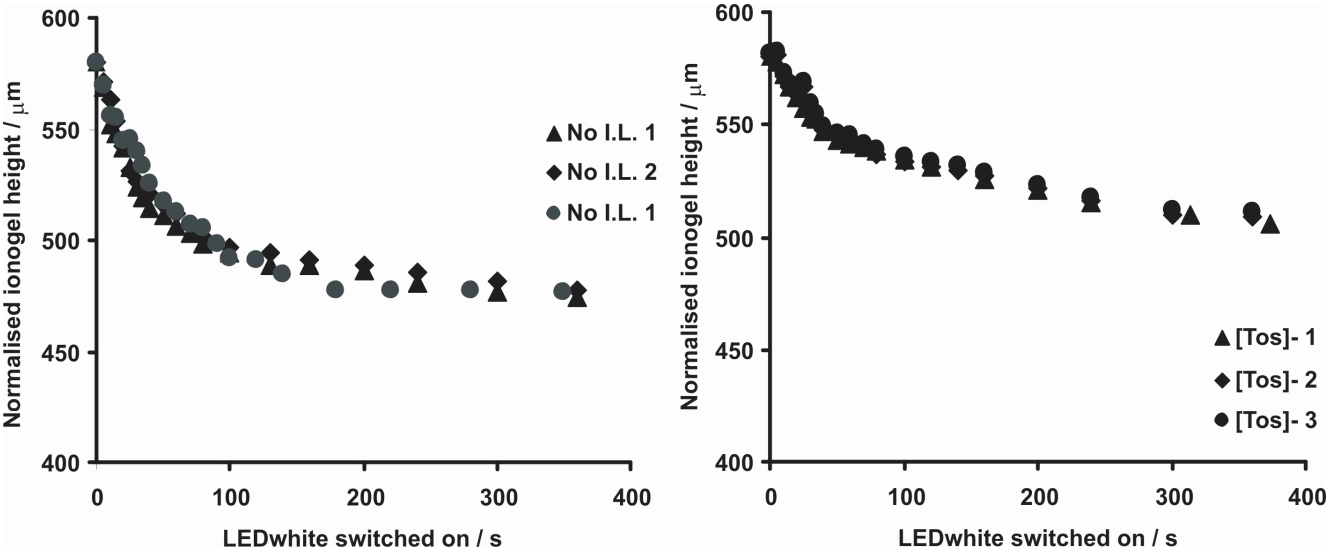
- VIDEO.2: Yellow colour evanescence of $[NTf_2]^-$ under white light irradiation. Similar behaviour was observed for the other ionogels.

Set-up picture:




**SI-Figure 1:** Set-p used to study the evanescence of yellow colour of the ionogels.

- Profilometer experiments: Reproducibility.




**(a)** **(b)**

**SI-Figure 2:** Three different experiments with independent photoresponsive gels **(a)** and $[Tos]^-$ ionogels (**b**). The error is not higher than 5 μm.

- Physical properties:

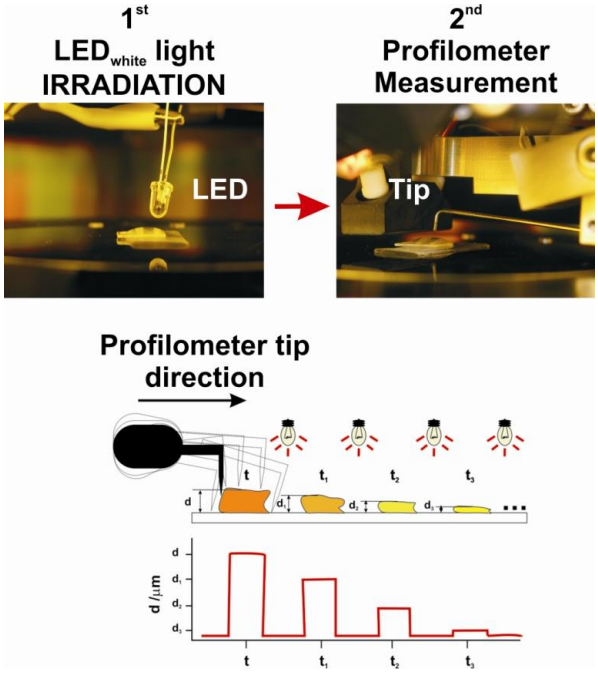
Mechanical tests were performed on ionogel samples which were produced in dog bone shaped moulds, with a $L_o$ 11.50 mm. Two sets of experiments were conducted with the ionogel samples; initially a hysteresis experiment was carried out to determine the elasticity of the samples up to 20 % strain. The second test was carried out with a strain rate of 20 % $min^{-1}$ after an initial preconditioning; the samples were tested up until failure. From the hysteresis experiments the stiffness values for the ionogels were determined and the Ultimate tensile strength and elongation at break were calculated from tests to the failure.

All the ionogels showed a certain level of plasticity; evidenced by the lack of hysteresis. Ultimate tensile strength and extensibility were quite variable. $[NTf_2]^-$ ionogel was the strongest and the stiffest of all the samples. The highest extensibility was attained by $[Tos]^-$ ionogel; however this ionogel was quite weak.

| Ionogel | Stiffness /$Nmm^{-1}$ | UTS /MPa | Elongation at Break /% |
|---|---|---|---|
| **$[dbsa]^-$** | 0.1713 | 0.12 | 187.19 |
| **No *I.L.*** | 0.0493 | 0.08 | 65.910 |
| **$[Tos]^-$** | 0.0187 | 0.02 | 545.48 |
| **$[dca]^-$** | 0.0149 | 0.02 | 131.53 |
| **$[NTf_2]^-$** | 2.9340 | 0.22 | 68.210 |

**Table 1.** Stiffness, ultimate Tensile Strength and Elongation at break values for the ionogels.

- Characterization of the photo-responsive phosphonium based ionogels using contact profilometer:




**SI-Figure 3:** Pictures (top), and schematic representation (bottom) of the experimental set-up used for measuring ionogel heights upon white LED irradiation using a Dektak 200-Si, Veeco contact Profilometer and a white light LED source; the distance from LED source to sample is 5 mm.