Electrowetting as an aid to conventional fingerprint visualisation techniques

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Why?

Aged and damaged latent fingerprints are often difficult to visualise because the particles (amino acids, fatty acids,..) in the fingerprint are stuck to the surface which makes them difficult to catch by the reagents. This is illustrated in the figures below, in which a droplet illustrates one single ridge.

Figure 2: Fresh and old droplet.

Electrowetting

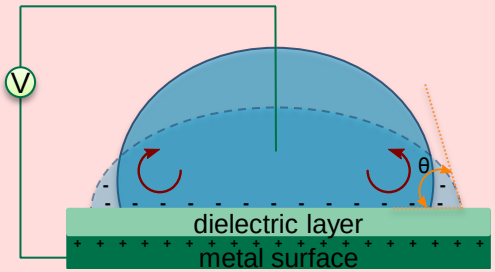

Figure 1: Schematic diagram of electrowetting.

By connecting the droplet and the metal surface to an electrode, they become oppositely charged. This will result in attraction of the droplet by the surface and flatten out the droplet.

How?

In this research, electricity will be used to detach the particles from the surface (so that they can react more easily with the fingerprint visualisation reagents) without disturbing the fingerprint ridge.
The change of the droplet shape will be determined by measuring the contact angle (θ) of the droplet as illustrated in Figure 1 and 3.

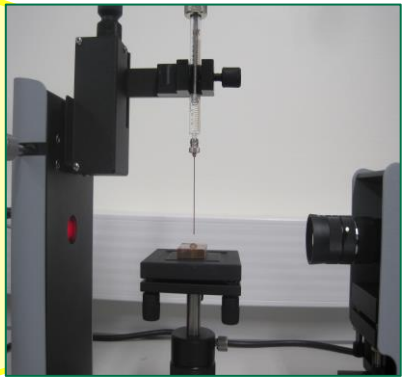

Figure 3: Contact Angle Measurement Instrument.

Other Applications?

Lab-on-a-chip: droplets can be mixed and merged to create chemical reactions by moving the droplet(s) along a path to a specific location. This principle is based on using individually addressable electrodes.

Figure 4: General Detection Chip.
Source: Gärtner et al. (Project SmartHEALTH, EU FP-6-2004-ISTNMP-2-016817)

Microlenses: the shape of flexible liquid lenses can be adjusted by electrowetting as illustrated in Figure 5. First demonstrated by Kuiper et al.[1] and Berge et al.[2] and further developed by Philips Research (Eindhoven, the Netherlands) and Varioptics (Lyon, France).

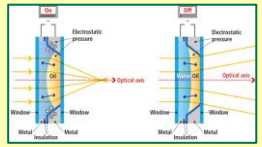

Figure 5: Schematic diagram of microlenses.
Source: Shamai et al., 2007

Displays: the amount of contact between a pixel and coloured oil can be varied by applying electricity, this could result in a 4x higher reflectivity of colour than regular LCD displays show; created by Philips Research & Liquavista (Eindhoven, the Netherlands)

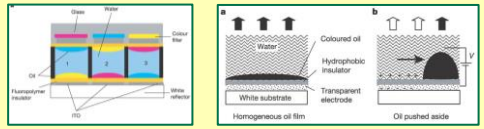

Figure 6: Schematic diagram of an electrowetting display.
Source: Hayes et al.,2003

References

1. Kuiper S. and Hendriks B. H. W.; Variable-focus liquid lens for miniature cameras; Appl. Phys. Lett. 85 1128 (2004)
2. Berge B. and Peseux J.; Variable focal lens controlled by an external voltage: an application of electrowetting; Eur. Phys. J. E 3 159 (2000)

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