



Technology Applications of Self-Assembling DACLCs: Information Storage and Encryption Techniques

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Optical Properties of DACLCs

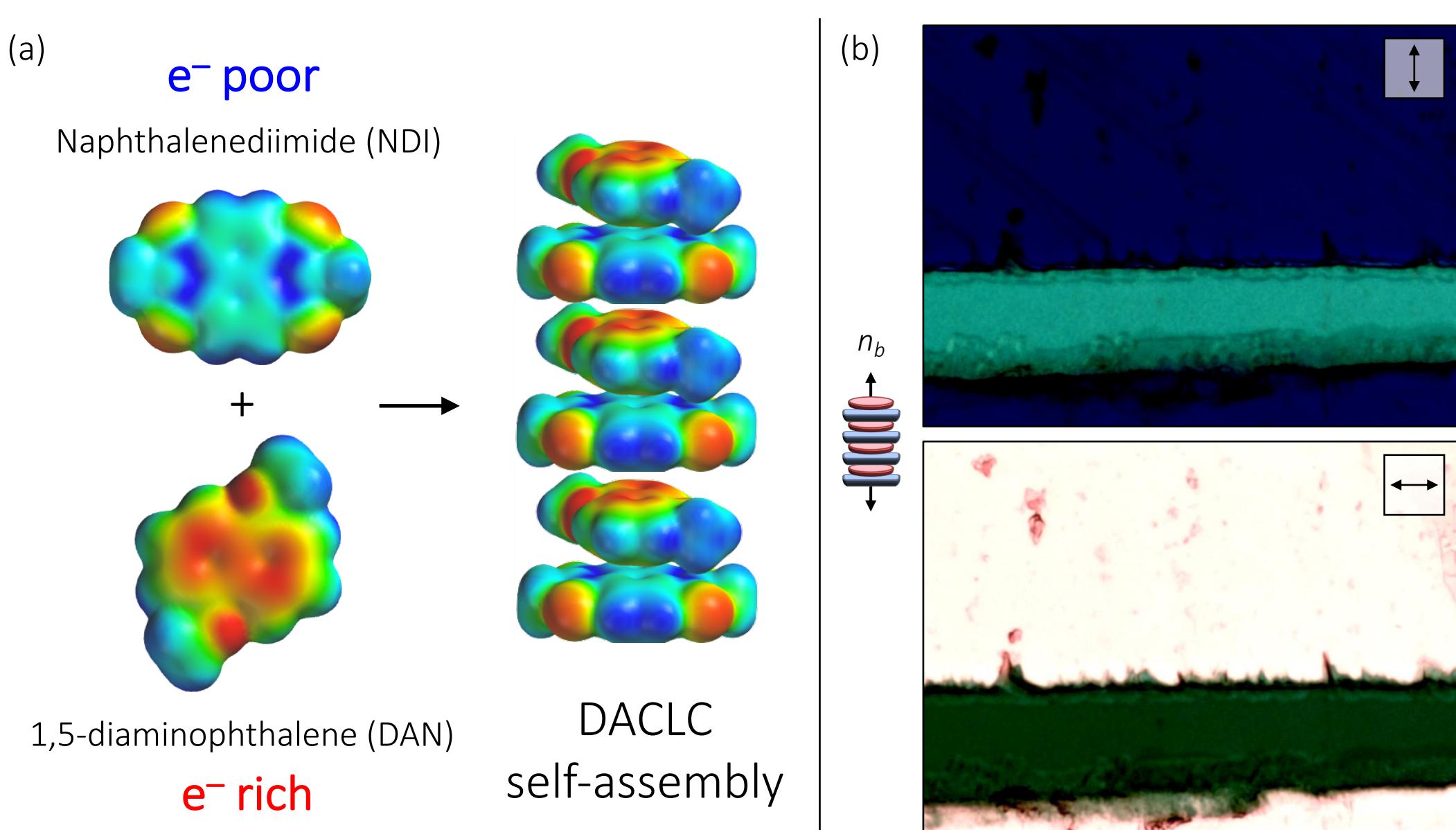


Figure 1. (a) Columnar self-assembly; (b) Background alignment along n_b with an isotropic (un-aligned) region through the middle, exposed to two orthogonal angles of LPL (indicated by arrows).

Transmittance Analysis

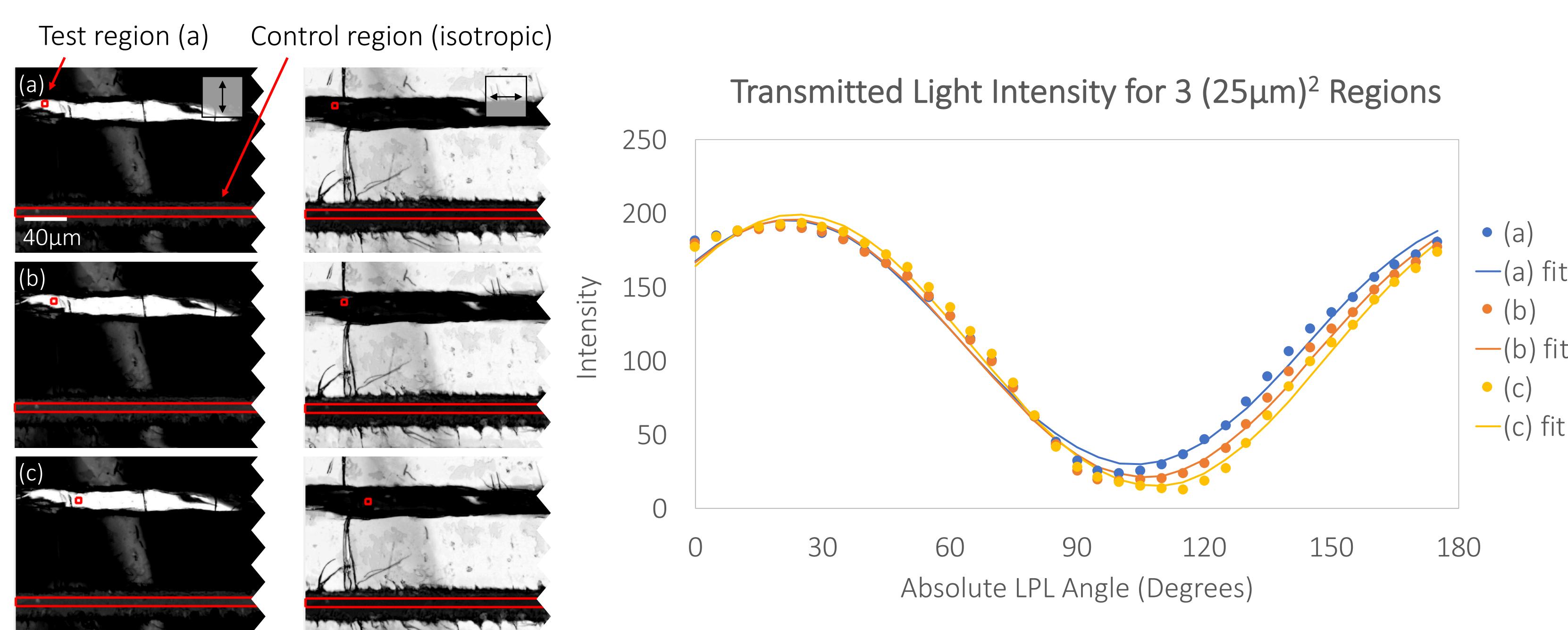


Figure 4. Images of an aligned sample exposed to LPL at 0°, 45°, 90°, and 135°, above images of three (25 μm)² test regions taken from this sample. Normalized grayscale intensity plotted against absolute angle of applied LPL, with corresponding sinusoidal regressions: $R^2_a = 0.9892$, $R^2_b = 0.9909$, and $R^2_c = 0.9916$.

Data Storage Application

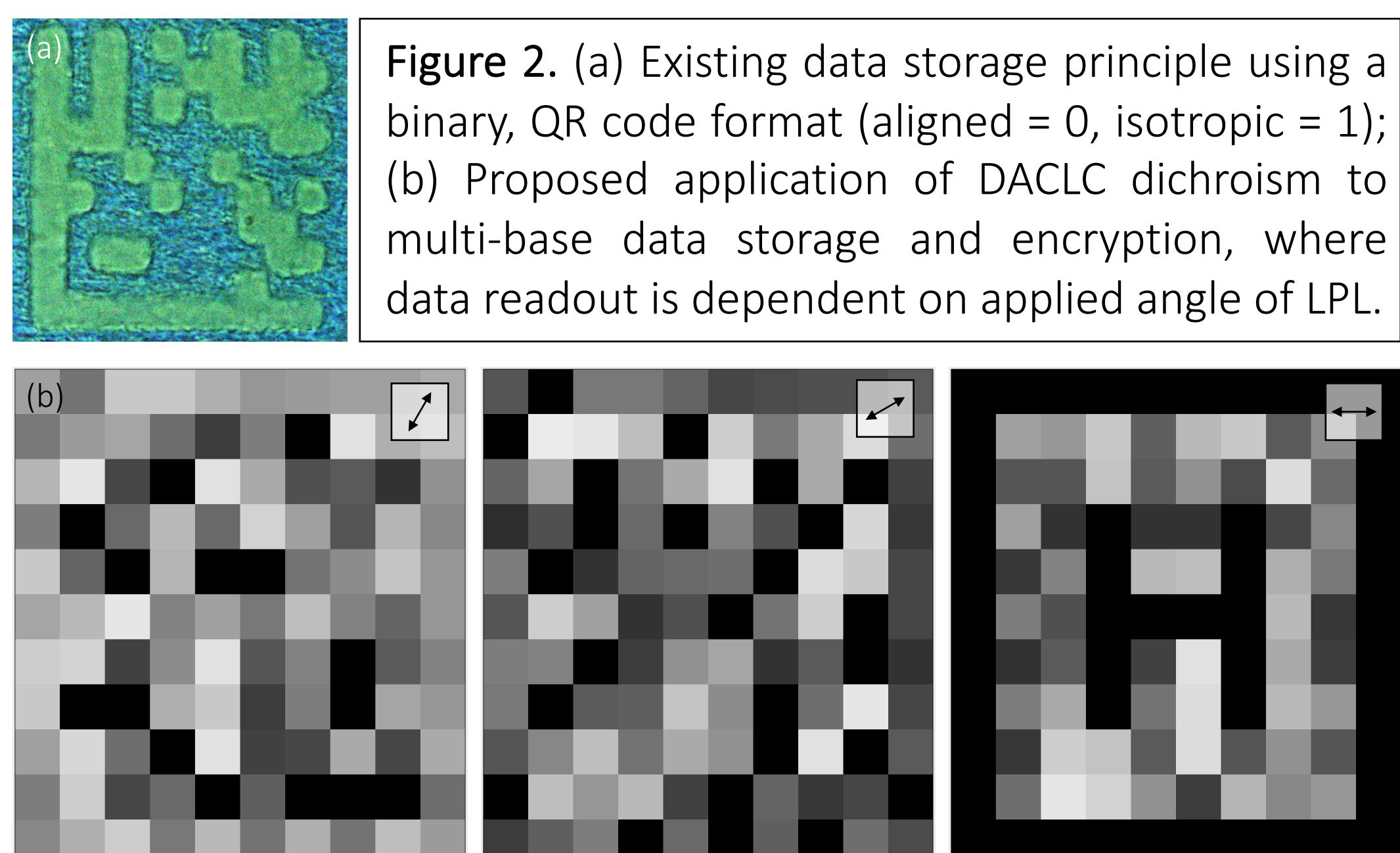


Figure 2. (a) Existing data storage principle using a binary, QR code format (aligned = 0, isotropic = 1); (b) Proposed application of DACLC dichroism to multi-base data storage and encryption, where data readout is dependent on applied angle of LPL.

Data Retrieval

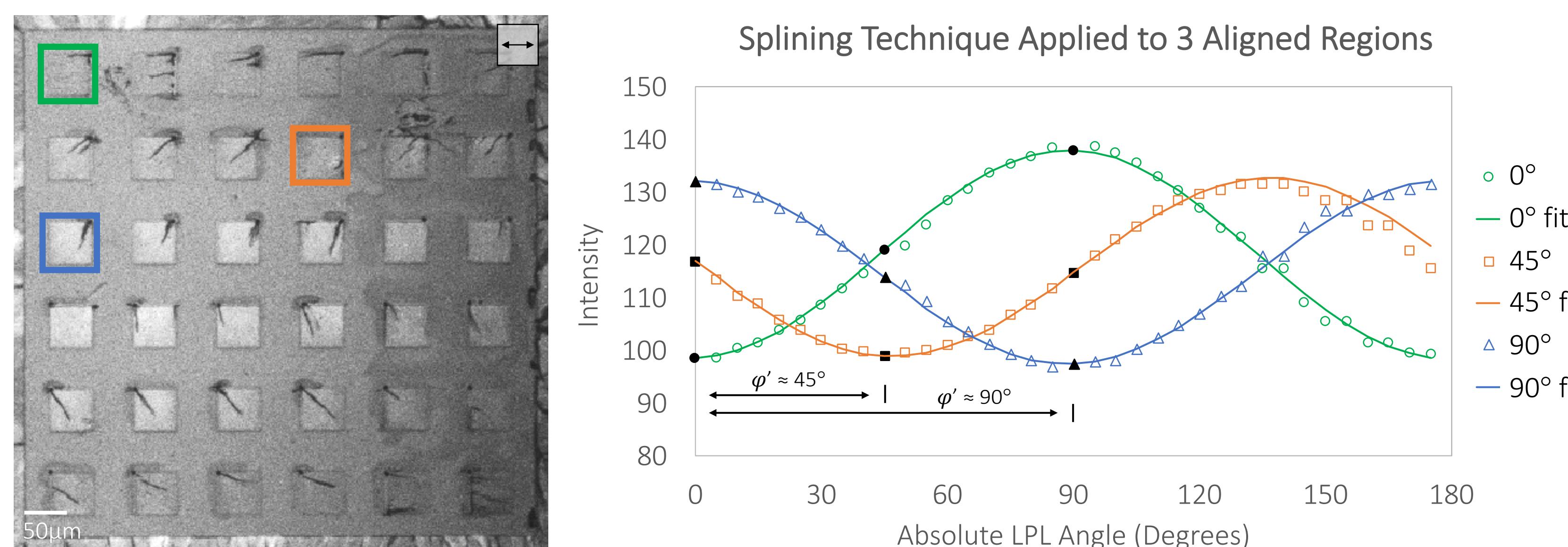


Figure 5. Angle of columnar alignment can be derived from phase using splining (only filled-black data points used in fitting). Using 12 possible write angles at 15° apart, we can achieve accuracy of over 99%.

Data Storage and Encryption Applications

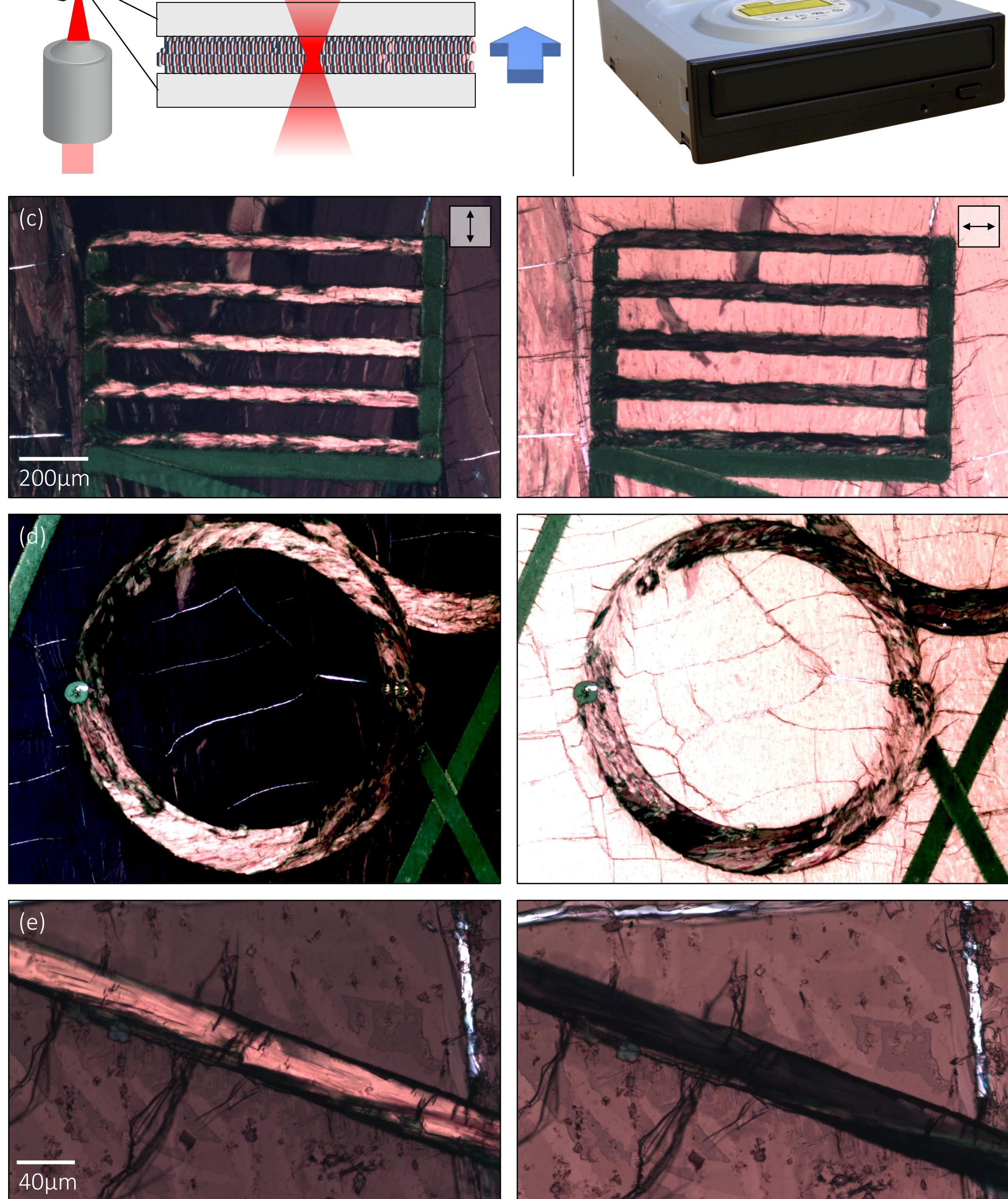


Figure 3. Using our (a) laser-writing setup (b) build from technology that has already been commercialized, e.g., in DVD reader/burners, we are able to produce (c) well-aligned regions, (d) in a variety of shapes, and (e) at micron-scale.

DACLC

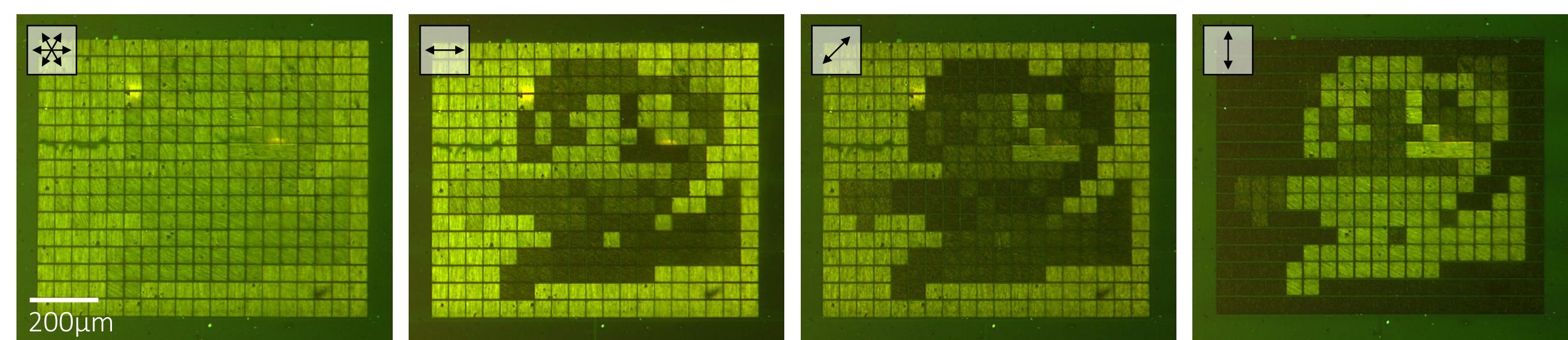


Figure 6. Information in the form of an image can be encoded, stored, and reliably read-out using a DACLC medium. Importantly, correct data readout is dependent on applying the correct angle of LPL.

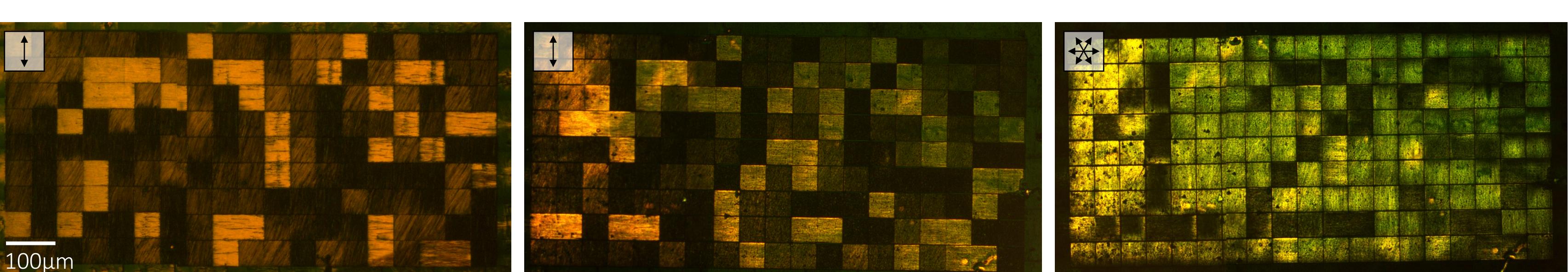


Figure 7. Two aligned, complementary mask "keys" may be overlaid to produce a readable data only when the two-film system is exposed to unpolarized light; unpaired, neither of the masks holds any data.

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References

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Van Winkle, M., Scrymgeour, D., Kaehr, B., and Reczek, J., *Adv. Mater.* 2018, 30, 1706787.