

Dye-doped Cholesteric Liquid Crystal Shells for Anti- Counterfeiting application

Chris Mathew^{1,2}, Ramadevi Surugu Pathinti², Saumya Ranjan Pradhan², Krishnakanth Chithari², Nandam Ashok¹, Jayalakshmi Vallamkondu^{2*}

¹Vellore Institute of Technology Amaravati, Andhra Pradesh, India, 522237

²National Institute of Technology Warangal, Telangana, India, 506004

*Corresponding author: jayalakshmiv@nitw.ac.in

Presenting author: chrismathew6967@gmail.com

Abstract

We have explored the application of Cholesteric Liquid Crystal (CLC) shells for Anti-counterfeiting method. The CLC shells consists of interesting optical properties which when doped with a fluorescent dye emits fluorescent colour under UV radiation. For the production of monodispersed shells, we fabricated a microfluidic device with the help of glass capillaries. The shells were observed under a Polarising Optical Microscope (POM) and their defect structures were studied. We employed an anti- counterfeiting method by encrypting a QR code with the help CLC shells, which were photopolymerised under ultraviolet light, for long-term stabilisation. In daylight, the code shows red and blue reflection colours, whereas under UV radiation the fluorescent colour of the dye is emitted. For both the conditions (daylight and UV light), the QR code was only able to decrypt under UV radiation. The colour variations are easily detectable with naked eye which makes it useful for real time applications. Since this is an easy technique, the security and chromic based applications will be more cost effective and efficient than traditional approaches.

Acknowledgement: The authors would like to thank the Department of Physics and the Centre for Research Instrument Facility (CRIF), NIT Warangal for providing research facilities.

References

[1] Mathew Schwartz, Gabriele Lenzini, Yong Geng, Peter B. Ronne, Peter Y.A Ryan and Jan P. F Lagerwall, *Cholesteric liquid crystal shells as enabling material for information-rich design and architecture*, Advanced Materials 30.30 (2018): 1707382

DOI: <https://doi.org/10.1002/adma.201707382>

[2] Buchaiah Gollapelli, Seeta Rama Raju Ganji, Arun Kumar Tatipamula, Jayalakshmi Vallamkondu, *Bio-derived chlorophyll dye doped cholesteric liquid crystal films and microdroplets for advanced anti-counterfeiting security labels*, Journal of Molecular Liquids 363(2022): 119952

DOI: <https://doi.org/10.1016/j.molliq.2022.119952>

[3] Y. Geng, J. Noh, I. Drevensek-Olenik, R. Rupp, G. Lenzini, J.P.F. Lagerwall, *High-fidelity spherical cholesteric liquid crystal Bragg reflectors generating unclonable patterns for secure authentication*, Sci. Rep. 6 (2016) 2–10

DOI: <https://doi.org/10.1038/srep26840>