Energy Saving, Transparency Changing Thermochromism in green synthesized ZnO nanoparticles doped Cholesteric Liquid Crystals for Smart Windows

S. P. Ramadvi[1], G. Buchaiah, Saumyaranjan Pradhan[1], V. Jayalakshmi[1*]
[1]Deparament of Physics, National Institute of Technology Warangal
e-mail: jayalakshmiv@nitw.ac.in

Electrically tunable smart window has been fabricated by using green synthesized Zinc oxide nanoparticles (ZnO NPs) dispersed in cholesteric liquid crystals (CLC). The fabricated device is semi-transparent in the planar state, opaque in the focal conic state and fully transparent in the homeotropic state. Interestingly, switching among these states is possible by just varying the applied voltage. The proposed device can even regulate the ambient temperature by controlling the sunlight. This type of smart window is developed by doping of ZnO NPs into Chiral nematic LC mixture, interestingly, as the concentration of ZnO NPs increases the transmittance decreases in Focal conic and it increases in Homeotropic state. The transmittance of NPs doped CLC is decreased from ~87% to 4% in the focal conic state (2.4 V/μm) and increased 4 % to ~ 90% in the homeotropic state (7 V/μm) with a short response time (< 1ms). The versatility exhibited by the device showed good stability even after repeatedly turning the electric field on and then off for 120 seconds. We have demonstrated the operation of privacy windows alongside smart windows by exploiting the capabilities of NPs and CLCs to reduce reliance on artificial lighting, heating and cooling building operation costs. The indoor temperature-regulation effects of Pure CLC and ZnO doped CLC devices were investigated using a solar simulator device. In order to regulate interior temperature and to conserve energy, it is anticipated that this technology may be used as windows for automobiles and buildings to control temperature and save energy.

References

[1] S. Pagidi, K. Sairam, M. Reddeppa, S. Ahn, Y. Kim, J. Kim, M. Kim, S. Hee and M. Yong, *Sensors Actuators B. Chem.*, 2022, **370**, 132482.

[2] H. Zhang, J. Liu, X. Zhao, J. Gao, C. Ma, Y. Zhao, R. Yao, Z. Miao and W. Shen, *Dye. Pigment.*, 2022, **203**, 110316.