Self-assembled silica nanoparticles for nano-structured surfaces to homeotropic alignment of nematic liquid crystals

Pankaj Kumar\textsuperscript{1*}, Seung Hee Lee\textsuperscript{2}, Kuldeep Kumar Raina\textsuperscript{3} and Shin-Woong Kang\textsuperscript{2}

\textsuperscript{1}School of Applied Sciences, Chitkara University, Rajpura, Patiala - 140401(Punjab), India
\textsuperscript{2}Department of BIN Fusion Technology, Chonbuk National University, Jeonju, Jeonbuk 561-756, Korea
\textsuperscript{3}School of Physics and Materials Science, Thapar University, Patiala 147-004(Punjab), India
\*E-mail: pkumartiet@gmail.com

We report an orientational effect in nematic liquid crystal (NLC) sandwiched in spherical solid silica nanoparticles (SNPs) coated ITO-glass substrates, controlled by self assembly SNPs. Two-dimensional (2D) SNPs assembly on ITO substrates in the form of multilayer were obtained by deposition of different average size SNPs under controlled evaporation of the solvent from a homogeneous SNPs solution. The morphology of the NPs assemblies could be controlled by several experimental parameters like NPs concentration, sonicating process and deposition time. The 2D multilayer of the NPs results in an additional phenomenon of homeotropic alignment (HA) of liquid crystal (LC) in a confined LC cell. This approach is based on the nature of an interaction of NPs multi layer with LC molecules and HA in the cell is induced as a result of surface roughness of the silica multi layers. The proposed cell exhibits similar electro-optic characteristics with faster switching as well as a dielectric response as of conventional polyimide-based vertical alignment (VA) display devices. The results provide insights to understand the HA of LCs on solid surface and hence opportunities to devise a novel technique for a HA of LCs. This approach is applicable to various current LC displays technologies to produce high informative displays at low cost and does not need any specific fabrication process.