

Automatic Vertical Alignment of Liquid Crystals by Directly Introducing Giant Surfactants

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For liquid crystal (LC) alignment, polyhedral oligomeric silsesquioxanes (POSS) can be considered as one of the promising candidates for the formation of vertical alignment (VA) of LC. However, because of their poor compatibility and weak interaction with LC hosts, the pristine POSS are highly aggregate themselves in the LC media and create the macroscopic particles, resulting in severe light scatterings. To overcome this barrier, we proposed and successfully synthesized the cyanobiphenyl monosubstituted POSS giant molecule (abbreviated as POSS-CBP1), which showed an excellent dispersion in nematic (N) LC media and formed the perfect VA of LC without using conventional polymer-based VA layers. On the basis of the systematic experiments and careful analysis, we realized that the cyanobiphenyl moiety chemically attached to the pristine POSS with an alkyl chain can significantly improve the initial solubility and interaction with LC media but finely tune POSS-CBP1 to gradually diffuse onto the substrate of LC cell for the formation of VA layer without forming the macroscopic aggregations. Therefore, the newly developed POSS-CBP1 VA layer can allow us to significantly cut the manufacturing cost as well as to open the new doors for electro-optical applications.

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