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# Topographically induced homeotropic alignment of liquid crystals on self-assembled opal crystals

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**Abstract:** The surface of multilayered opal crystals resulted in homeotropic alignment of liquid crystal (LC), originated from the surface topography of opal crystals rather than a chemical nature of the nanoparticles. The polar anchoring energy ($5.51 \times 10^{-5}$ J/m$^2$) of the crystal surface for nematic LC molecules was in a similar range to the conventional polyimide alignment layer ($2.11 \times 10^{-5}$ J/m$^2$) used for commercial applications. The critical length scale for anchoring transition was approximately $L_w$ = ~1 μm. If a diameter of particle $d$ << 1 μm for opal crystals, LC molecules preferred to anchor vertically to the surface to minimize elastic free energy of bulk LCs. The LC favored a planar anchoring if d >> 1 μm. The results provide crucial insights to understand the homeotropic alignment of LCs on solid surfaces and therefore offer opportunities to develop novel materials for a vertical alignment of LCs.



**OCIS codes:** (230.3720) Liquid-crystal devices; (160.3710) Liquid crystals.

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