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Effective Medium Theory for an ultra thin liquid crystalline films and its consequences for the ellipsometric modeling -

Technological applications of liquid crystals (LC) have been for many decades a continuous driving force for investigating properties of this fascinating state of matter by theorists as well as by experimentalists. Still many questions about LC properties need to be answered. Special attention is paid to the optical characteristics of liquid crystalline thin films. In the current presentation we show an Effective Medium Theory for an ultrathin film of nematic liquid crystals that is based on the capacitor connection rule. This theory provides the effective dielectric tensor for a continuously changing order of the liquid crystal which emerges from the interaction of molecules with the substrate which causes different degree of ordering with respect to the distance from the substrate. The needed order tensor has been obtained on the basis of the density functional theory. The resultant spatial changes of the particles ordering will influence the overall dielectric and optical properties. The changes of the dielectric properties due to the influence of the walls are shown to be as strong as several percent with respect to the bulk properties. The proposed EMA theory allows to calculate changes of polarisation in the light reflected or transmitted through the sample and finds its application to ellipsometric modeling of optical properties.

Summary

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