The dynamical behaviour of Policryps/Poliphem composites

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Recently there has been a lot of interest in the physics and possible technological applications of liquid crystal-based tuneable Bragg gratings. Such optical devices can be realised using recently manufactured composite materials based on a sequence of polymeric sheet alternated by layers containing only liquid crystal. Thus, by their intrinsic nature they are realized in form of grating. Such composites are sometimes known as Policryps or Poliphem.

Recent experiments on existing samples have clearly demonstrated a peculiar dependence of relaxation times on the actual external field applied (both magnitude and duration) after the operating voltage switch off. The optical response dynamics curve needs at least double exponential function for a good fit in this case [1]. One may arrive at an idea of two different phenomena responsible for LC director reorientation, hence for optical response of Policryps/Poliphem gratings.

We have proposed a theoretical model of director reorientation in such composites, in which both bulk behaviour in the LC stripes and surface polymer-LC interaction is taken into account [2]. Here we report on the further progress toward the full diffraction efficiency theory of Policryps/Poliphem gratings. Within this model we explain the dynamical behaviour of holographic gratings characterized by a nematic film-polymer slice sequence structure, as well as other polymer-LC phase separated composites.

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References

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