Bio Networks for Electro-optical Liquid Crystal light shutters

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Cellulose derivatives composites for electro-optical application were introduced in 1982 by Craighead and co-workers [1] followed a few years later by the development of a new type of cellulose derivative electro-optical cell referred to as cellulose based polymer dispersed liquid crystal (CPDLC) [2,3].
In opposition to the early Polymer dispersed Liquid Crystal (PDLC) systems, where the liquid crystal component was phase separated out of the polymer matrix forming droplets uniformly distributed in the matrix, the basic optical cell of a cellulose derivative composite referred to as CPDLC, was formed by a rough cellulose derivative polymeric film surrounded by two nematic liquid crystal layers and the set placed in between two transparent conducting rigid or flexible substrates. These cells had very challenging properties, presenting high transmission coefficients values (around 0.8), but suffering from rather high turn on voltages (around 1,5V/μm) [4, 5].
Recently we presented light scattering electro-optical devices where layers of cellulose derivatives networks were deposited as nanofibers directly onto the conductive substrates by electrospinning. These devices can be used as shutters or as privacy windows since they can be electrically controlled to scatter light (OFF state) or to be transparent (ON state) [6].
We are presenting a new type of light shutters based on the use of spider silk networks as a mean to distort the liquid crystal molecules orientation, which is required to achieve a light scattering state. We use thin fiber networks naturally obtained from spider webs. The spider silk changes its composition and structure depending on three factors: 1) silk gland type, 2) interspecific variability and, 3) intraspecific variability [7] and different types of silk will be studied. After collecting the spider network fibers and place it between the two transparent conducting substrates, the test cells are filled with a nematic liquid crystal. The results of the electro-optical properties obtained with this system will be compared with the ones obtained with a similar system produced using electro-spinned fibers of cellulose derivatives [6].

References

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