Introduction

As is it well known, the nematic liquid crystal (NLC) shown a quadratic effect respect to an external field, this means that in technological applications, as in display technology, they can bee switched ON by an applied voltage but they must bee turned OFF without applied voltage. The consequent phenomenon of spontaneous relaxation is rather slow. An important advantage of any polarity sensitive material is the possibility to control both ON and OFF state by an external field, avoiding the free relaxation process. Wen ON and OFF state are controlled by an external AC field the response time result considerably reduced. A similar effect is known, for example, in NLC having inversion of the dielectric anisotropy sign on frequency scale. However, in this case, an high power value is requested because of the dielectric losses in high frequencies regions. In the special case of a hybrid cell (omeotropic orientation on one of the confining layer and planar on the other one) is possible to observe the linear flexo electric effect typical in the polar structures. Nevertheless the flexo electric polarisation is too small and the asymmetry of the electrooptical response is too weak to bee used in technological applications.

Another possibility to obtain a polarity sensitive electrooptical response is that to use NLC cells with asymmetric peripheral conditions in which the bistability of the commutation is due to a particular interface properties between solid and nematic surface. The firsts materials used to make NLC cells with asymmetrical electrooptical response has been the tungsten trioxide (WO_3) that is a well known material due to its particular structural configuration that allows to a reversing intercalation and deintercalation process of small cations as H^+, Li^+, Na^+. Subsequently has been used mixed oxide with mixed conducting properties as bismuth –vanadium oxide and titanium – vanadium oxide deposited by sol gel synthesis on glass-ITO substrate and used as electrode in NLC cells. The sol – gel process is a method used for thin film deposition on nearly whatever kind of surface and, respect to other deposition process, it has the advantage to bee very simple and economic. In this two case, an important correlation between the structure of the film and the rectification effect has been found. In fact the best result in terms of contrast and rectification of the electrooptical response has been obtained with NLC cells containing oxide film that had previously annealed at high temperatures. Micro raman analysis has shown that this kind of films has a transition from

amorphous to crystalline phase for thermal treatment around to 500°c [1], [2].

It’s just in this research seam that the present triennial work on transparent thin film oxide is inserted. In particular, has been analyzed the vibrational spectra and the main morphological and conductive characteristics of tungsten trioxide (WO_3) and lead zirconate titanate (PZT) deposited by sol-gel process on ITO substrate after having submitted them to different thermal treatment. The following step has been the observation of the electrooptical response of the NLC cells in witch one of the electrode were constituted by the aforesaid materials. In the case of PZT films, the study of the conductivity has also been effected as a function of different substrate (copper and ITO).

References.

[1] E. Cazzanelli , S. Marino , V. Bruno , M. Castriota , N. Scaramuzza, G. Strangi , C. Versace , R. Ceccato and G. Carturan: *Characterisations of mixed B_i/V oxide films, deposited via sol-gel route, used as electrodes in asymmetric liquid crystal cells.*

[2] S. Marino, M. Castriota, V. Bruno, E. Cazzanelli, G. Strangi, C. Versace and N. Scaramuzza: *Electro-optical Investigations of nematic liquid crystal cells containing Titania-vanadia thin films prepared by sol-gel synthesis.*

.

.