BENT CORE LIQUID CRYSTALS FOR MICROELECTRONICS

Idei Programe PNCDI-II, Project ID_356/2008

In the last decade, non-conventional liquid crystals (compounds with complex architecture) were intensively investigated due to the special mesophases which are not usual for the classic liquid crystals. A particular attention is focused on bent core systems, capable of inducing the so called banana phases. Recently, there were obtained evidences that, due to the biaxial form of the molecules, such molecules are capable of ordering on two directions in the biaxial nematic mesophase (biaxial liquid crystals).

Despite numerous studies, indubitable evidences for the existence of biaxial nematic phase were produced only in 2004. The importance of the event was mentioned even by prestigious journal Nature in a paper suggestively entitled ***A missing phase found at last?***. Even there are only few examples of biaxial liquid crystals in the literature, a lot of potential applications are expected, based on a thousand times faster responses on external stimuli as compared with the classic liquid crystals. The study of non-conventional bent core mesogenic systems is very actual because of the opened perspective concerning the discovery of new intelligent materials with special properties.

The goals of the project deal with the domain of *bent core* liquid crystals by synthesis and characterization of new type of structures, which include mesogenic blocks that contain at least one azo linking group. The researches will bring contributions to development of knowledge through studies of structure–properties relations which govern the processes of supramolecular organization of such type of materials. The molecular modeling and simulations which will be made during the project may bring essential contributions in elaboration of theoretical models about the connections between architecture of molecules and their way of self-assembling in the biaxial nematic mesophase.

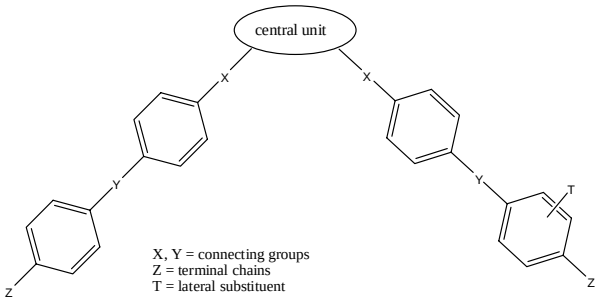
The project originality lies in joining of properties induced by the presence of the central bent core (that confers potential molecular biaxiality, responsible for fast switching at the action of electric stimulus) with those conferred by mesogenic blocks that include photoisomerizable linking groups, sensible to the action of UV-VIS radiations, and that can modify appreciable the physical properties of the system being in mesophase.

Although widely used in designing of other type of compounds, inclusively for conventional liquid crystals, the number of synthesized bent core compounds which include azo groups is very low. Maybe it is not casual the fact that one of the first compounds for which certain evidences concerning the existence of nematic biaxial mesophase have been obtained is a compound that includes an azo group into the structure. The obtained products might be used in LCD color technology and as obturators for micro-displays.

The project theme is extremely complex being placed in both in applicative and fundamental research domains based on the synergy of multidisciplinary approaching in chemistry, physics and materials science and might bring important contributions in obtaining of organic materials with multiple applications in liquid crystals based on electronic displays that considerable improve the switching properties or as optical compensation films.

The research project is proposed for 36 months and concerns the synthesis and full characterization of some liquid crystals with potential biaxiallity, that will increase the area of knowledge in a field that has to be developed and consolidated, taking into consideration the potential applications before mentioned.

Basically, the goal of the project is synthesis and characterization of some new bent core liquid crystalline derivatives with special properties and containing a [1,3,4]oxadiazole, 1,3-benzene-disubstituted or 2,7-naphtalene-disubstituted cores and photoisomerizable azo groups, with the following general formula:



The project will focus on studies on mesomorphic properties, thermal stability, response on UV/VIS irradiation in solutions and thin films, and, finally, establishment of structure - properties correlations.

The project is divided into three main parts dealing with symmetric, non-symmetric and symmetric/non-symmetric laterally substituted banana-shaped liquid crystals.

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