Ionic paramagnetic liquid crystal for photovoltaic studies

Liquid crystals as self-organizing materials are very promising candidates to design conductive materials for molecular electronics and photovoltaic applications. Photovoltaic devices allow for direct conversion of light into electricity, and for this reason are important components of a renewable energy method. In this context, there is the growing interest in semiconductor organic materials due to their commercial availability and facile modification of their structure and properties. Some of the desired materials for the construction of solar cells are photo-sensitized compounds, which absorb the visible light. The example of such a moiety, called a chromophore, is 6-oxoverdazyl.

The proposed liquid crystalline materials (Figure 1) are based on the 6-oxoverdazyl core, which possesses magnetic properties and also exhibits a broad absorption in the visible range. The 6-oxoverdazyl is one of a few radicals with sterically accessible π-delocalized spin system, which is important in the design of self-organizing conductive materials. Close contact of the molecules cores causes electronic and magnetic interactions between them and facilitates charges transport and exchange of spin information.

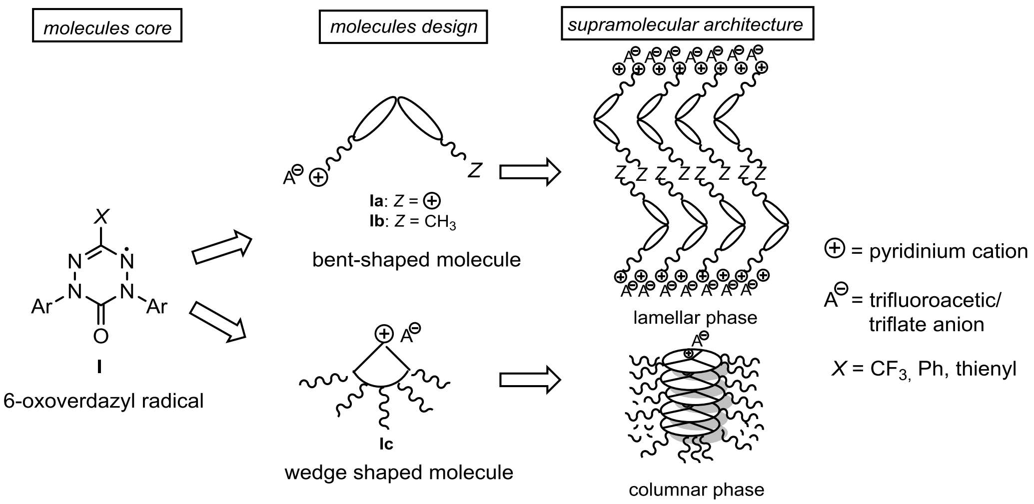

Figure 1. Designed ionic derivatives of 6-oxoverdazyl **I** forming liquid crystalline phases.

The main goal of the proposed research program focuses on the improvement of photo-current efficiency (current caused by absorption of light) through the introduction of ionic fragments into the molecule. The presence of the ions will cause more favorable arrangement of the 6-oxoverdazyl chromophores in the fluid phase, and will increase dielectric constant of the material. The project assumed the synthesis of a new class of ionic compounds: bent-shaped and wedge-shaped molecules (Fig. 1), which arrange into layers or columns. The next step will be a physiochemical and photophysical (includes photovoltaic) investigations of obtained materials. These materials should exhibit electron conductivity along the layers and columns formed by verdazyl rings and ionic conductivity. Moreover, new channels for charge transport may be formed by cations (with the appropriate reduction potential). The proposed project constitutes the first step of broad research program in advanced functional ionic materials.