

Description for general public

Ferroelectricity is an important physical phenomenon in our world. The basics of this phenomenon were used to build capacitors of high capacity. Other possible applications include construction of semiconductor components, ferroelectric random access memory (FeRAM) and applications in photonics or molecular electronics. Further advancements in organic ferroelectricity depend on the construction of suitable organic dyes. Coumarins are a very important class of organic compounds, mainly because of a wide range of applications, such as optical brighteners, fragrances and fluorescence microscopy. Seeking of new functional materials showing intriguing optoelectronic characteristics, we have discovered the first head-to-tail bis-coumarin. Linking two coumarin moieties with amide functionality opened a completely new area for exploration.

The primary goal of this project is to build larger and more rigid organic architectures possessing multiple coumarin units. They will possess a large electric dipole moment and various structures in solution as well as in the solid state. We plan to obtain, characterize and investigate optoelectronic properties of these new, heterocyclic compounds. Experimental research will be supported by theoretical calculations.

The relationship between the optical properties and the number of coumarin units, position of linkage, type of tether will be investigated, since the target molecules will be novel heterocyclic materials which may possess suitable electrochemical and optoelectronic properties hence they may be utilized in various applications in the future.

Technological changes, which occurred within the last decade induced the demand for new organic materials. In particular heterocyclic aromatic compounds are critical for such applications as: organic light-emitting diodes (OLEDs), artificial photosynthesis (photovoltaics), fluorescent probes etc. These technologies have a direct influence on medical diagnostics, cell phones, digital cameras and organic solar cells etc. Although many such compounds exist, there is continuous search for new ones possessing better properties. The final effect of this project is the development of new organic dyes, which may have interesting optical properties. They might be used in organic electronics or/and as fluorescent markers.