Synthesis and characterisation of new types of supramolecular polymers based on amino-acid functionalised organic platforms

The aim of the project is the synthesis of novel, highly ordered supramolecular polymers based on diimides functionalized with natural amino-acids. Synthesis of scheduled polymers will be performed through the self-assembly process in which the appropriately designed monomers will aggregate spontaneously *via non*-covalent supramolecular interactions such as hydrogen bonding and π-π stacking. This process have been already been used for the preparation of *non*-covalent polymers with unique electrical (self-assembled semiconductors) or optical (fluorescent and photovoltaic dyes) properties.

The project assumes the synthesis of three series of organic compounds based on diimide cores, which have not been explored, followed by their functionalization with natural amino-acids under microwave conditions. The subsequent, thermodynamically controlled, polymerization *via non*-covalent interactions will yield the novel classes of supramolecular polymers (Figure 1). Precise selection of substrates with specific geometry and appropriate functional groups will provide polymeric materials with unique structural and physicochemical properties that can give them potential applications in modern nanotechnology.

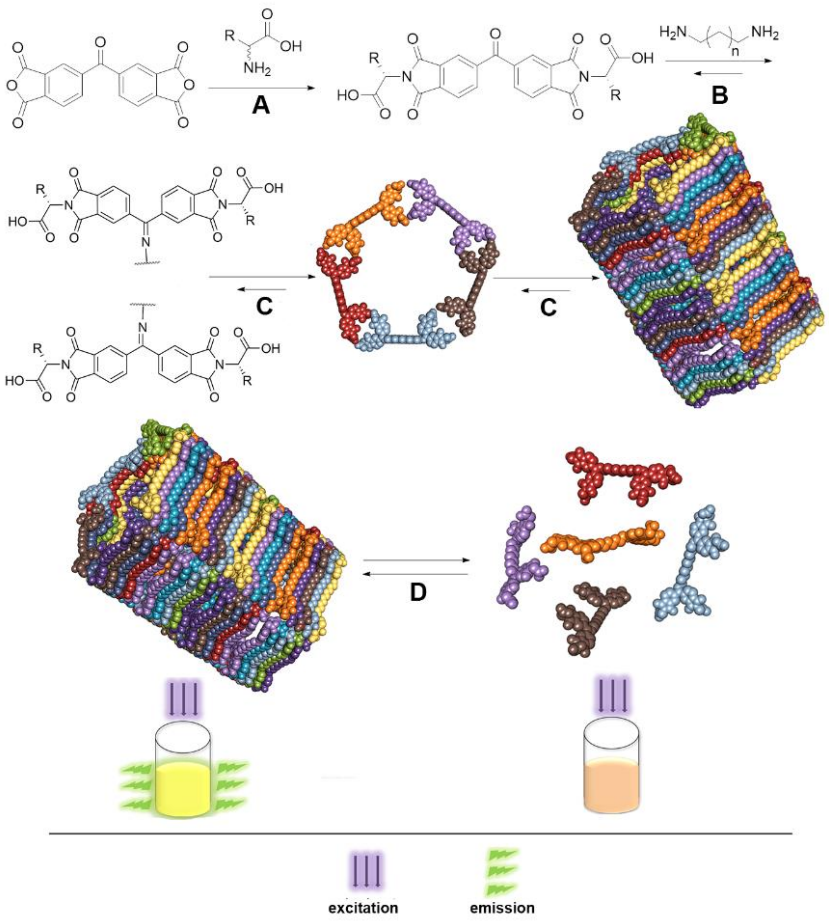

Figure 1. *Work concept presented graphically based on one of the designed compounds. From the monomers synthesis (A, B) through hierarchical self-assembly (C), up to functional polymers (D).R=amino-acid residue.*

Non-covalent polymers are an extremely important class of supramolecular compounds not only due to their fascinating and unique structural characteristics, enabling to broaden the recent knowledge about self-assembly phenomenon, but also their physicochemical properties thanks to whom they may find potential application in many areas such as: nanotechnology, nanoelectronics, photovoltaics, and fluorescent dyes. For these reasons, it is highly reasonable to search for new supramolecular polymers with an even more interesting and more controlled properties, and to optimize the synthetic pathways to obtain them in the most efficient way while minimizing costs.