

Self-organizing, switchable, organic optical medium for exciton polaritons generation

The coupling of light and matter have intrigued the humanity over last centuries. Exploring the experiment effects of classical optics and later quantum optics we gain the knowledge leading us to unique optical micro-laboratories – microcavities. The microcavity is a closed space of a micrometer size, where light is confined at very specific conditions, forming standing wave or wave traveling in circular manner. Plenty of new quantum effects or enhanced classical effects are observed in such tightly confined geometries. The microcavity research expansion was strongly correlated and stimulated by rapid progress of crystal growth technologies. From the material point of view, the microcavity devices have been constructed from solid state materials for many years but recently soft matter slowly starts to be important player of puzzles, taking often the key role of the whole device. The project is devoted to development of soft matter, self-organized materials, being the active medium of optical microcavities. The medium is linking two functionalities, first possess self-organizing ability and electric field tunability with second – immersing the emitter system and in one case, tune its emission parameters. While the emitter system is combined within tunable microcavity, it can work as a source of bosonic quasiparticles, called excitonic polaritons. Such quasiparticles like other bosonic particles, obeying the Bose-Einstein statistics, allow them to occupy the same quantum state by numbers of particles. As other bosonic particles polaritons are giving several interesting experiments like Bose-Einstein condensation, superfluidity etc. The main aim of the project is creation of set of novel materials being the active optical medium, dedicated for optical microcavities. Such Optical mediums, will allow deeper and wider investigations in the areas marked above. Additionally the development of such self-organized liquid crystalline blend with organic and inorganic emitters, might be exploited in other areas of photonics, spintronics, organic lasing being at the frontier of science.