

There is a great demand on cheaper, faster, better and energy-saving color displays, light sources, sensors and lasers as well as renewable energy sources, for instance, devices that can harvest sunlight and transform it into an electric current. To construct such devices, materials are needed that exhibit useful specific physical or chemical properties, for instance, efficient emission of light and/or high absorption of sunlight. Such materials should also be simple and cheap for fabrication. Materials that can be used to convert energy of light into electricity are called photovoltaics and most widely used material is silicon. A device that harvests sunlight and transforms it into electricity is called a solar cell or photovoltaic cell. Another group of important materials are those that emit light when current flows through them. These materials are used for the construction of light-emitting devices (LEDs) that found application as color displays (in cell phones, monitors etc.), lighting, telecommunication, biomedical imaging and many others. Most light-emitting and photovoltaic materials are purely inorganic and often difficult or expensive to obtain. There is, however, another way for a fabrication of such materials, i.e., synthesis of organic-inorganic hybrid materials that are built of inorganic components and organic components. A new group of materials that are considered as the future of solar cells are materials built from divalent cations (lead, tin or germanium) coordinated to halide anions (iodine, bromine or chlorine) and organic cations or cesium. These materials are also predicted to play a significant role in next-generation LEDs, sensors, lasers and much more. They have similar structures and are often called perovskites. The main advantages of these materials are that they are cheap and easy to make, can be easily tuned to emit light of a variety of colors and strongly absorb sunlight, enabling application of ultrathin films in solar cells. In our project, we have decided to focus on compounds with methylhydrazinium cations. A few examples of these perovskites have been discovered by us a few months ago and the up to now reported data show that these compounds exhibit very unusual and interesting properties that make them promising functional materials. We want to study more deeply three of the known analogues and synthesize a number of novel perovskites comprising methylhydrazinium cations and exhibiting various structures and properties. We will characterize their structural features, crystal lattice vibrations as well as optical and electrical properties in a broad temperature range. Studies of these perovskites will help to answer questions, like how the modification of chemical composition affects the arrangement of structural units, the bonding forces and properties. This information will allow us to propose further ways for designing new metal halide perovskites with improved physicochemical properties, especially optical ones.