New easily-synthesisable and modifiable organic materials for applications in luminescent devices

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Arylboronic acids have found many applications in diverse areas of chemical science, such as organic synthesis, catalysis or crystal engineering. They can be also used as low-cost luminescent complexes (e.g., borinic-type compounds) for applications in optoelectronic devices. Quite recently, we have introduced a new class of cheap, easily-synthesisable and modifiable organic luminescent materials based on ortho-phenylenediboronic acid. The acid reacts with 8-hydroxyquinoline in high yield, both in solution and under mechanochemical conditions, and forms a brightly luminescent 8-oxyquinoline complex. More importantly, the obtained complexes appeared to be electroluminescent. Similarly to the well-known borinic-based luminescent materials tuning of the emitted colour can be achieved mainly by modifications of the N,O-donor fragment.

Therefore, here we present a series of ortho-phenylenediboronic acid complexes with luminescent N,O-donor compounds (Figure 1). The latter species themselves contain phenyl fragment and imidazo[1,2-a]pyridine ring, and thus may easily form intramolecular hydrogen bonding, which enables a further proton transfer. The proton transfer is responsible for their luminescent properties and can be tuned via the phenyl ring substituent character and a solvent choice. In the complex with ortho-phenylenediboronic this proton transfer is disabled. Hence, we checked the impact of the complexation of boronic acid on luminescent properties of the selected N,O-donor species. All new complexes were crystallized and structurally characterized using X-ray diffraction technique. Additionally, we examined their luminescence properties both in solution and in the solid state. The experimental data were supported by periodic energetic calculations and TDDFT studies.

Keywords: luminescent complexes, boronic acid, crystal engineering, spectroscopic properties

Figure 1. Luminescent properties of single crystals of new adducts (left panel). Schematic representation of new complexes based on ortho-phenylenediboronic acid and imidazo[1,2-a]pyridines (right panel).