Blue emitting organic semiconductors under high pressure: status and outlook

This review describes essential optical and emerging structural experiments that use high GPa range hydrostatic pressure to probe physical phenomena in blue-emitting organic semiconductors including π-conjugated polyfluorene and related compounds. The work emphasizes molecular structure and intermolecular self-organization that typically determine transport and optical emission in π-conjugated oligomers and polymers. In this context, hydrostatic pressure through diamond anvil cells has proven to be an elegant tool to control structure and interactions without chemical intervention. This has been highlighted by high pressure optical spectroscopy whilst analogous x-ray diffraction experiments remain less frequent. By focusing on a class of blue-emitting π-conjugated polymers, polyfluorenes, this article reviews optical spectroscopic studies under hydrostatic pressure, addressing the impact of molecular and intermolecular interactions on optical excitations, electron-phonon interaction, and changes in backbone conformations. This picture is connected to the optical high pressure studies of other π-conjugated systems and emerging x-ray scattering experiments from polyfluorenes which provides a structure-property map of pressure-driven intra- and interchain interactions. Key obstacles to obtain further advances are identified and experimental methods to resolve them are suggested.

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