Polymorphic tuning of a flexible organic crystal optical waveguide

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Crystalline molecular materials are usually brittle and are prone to break upon external mechanical force. This fragility poses challenges for their application in next-generation technologies, including sensors, synthetic tissues, and advanced opto-electronics. The recent discovery of mechanical flexibility in single crystals of molecular materials has solved this problem and enable the design of smart flexible device technologies.[1] Mechanical flexibility of organic crystals can be tuned by altering the weak interactions in the crystal structure, for example through polymorphism. Here we report 4-bromo-6-[(6-chloropyridin-2-ylimino)methyl]phenol (BCMPMP) as a promising candidate for future waveguide technologies. It turns out that BCMPMP has two different polymorphs with distinct optical and mechanical properties. Form I shows brittle behavior under mechanical stress and exhibits very weak emission at 605 nm (λ_{ex} = 425 nm) together with a low photoluminescence quantum yield (Φ = 0.4 %). In contrast, Form II has a large plastic (irreversible bending) regime and a bright emission at 585 nm (λ_{ex} = 425 nm; Φ = 8.7 %). Making use of favorable mechanical flexibility and optical properties, form II was explored as a bendable optical waveguide. Light was successfully propagated through a straight-shaped and mechanically deformed BCMPMP crystal. Depending on the light source, active or passive waveguiding could be achieved. So BCMPMP can also be used as a flexible wavelength filter.

[1] Annadhasan, M., Agrawal, A. R., Bhunia, S., Pradeep, V. V., Zade, S. S., Reddy, C. M. & R. Chandrasekar (2020), *Angew Chem Int Ed*, **59**, 13852-13858.

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