Mechanically plastic molecular crystals for shapeable optic waveguide

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Molecular crystalline materials are usually brittle and are prone to breaking when mechanically stressed. This fragility greatly limits they application in next the generation of adaptable, functional materials. The recent discovery of mechanical compliancy in molecular crystals has solved this problem.[1] Based on the nature of the deformation, molecular crystals can be divided into being plastically (irreversibly) or elastically (reversibly) bendable. The plastic deformation is generally associated with anisotropic molecular arrangements and the existence of low energy slip planes which allow a permanent motion within the lattice. Here we report 4-bromo-6-[(6-chloropyridin-2-ylimino)methyl]phenol (CPMBP) as a promising candidate for future waveguide technologies.[2] CPMBP has been found to have two different polymorphs with distinct optical and mechanical properties. The brittle crystals of Form I exhibits very weak emission at 605 nm (λ_{ex} = 425 nm; photoluminescence quantum yield Φ = 0.4 %). In contrast, Form II has a large plastic regime together with a bright emission at 585 nm (λ_{ex} = 425 nm; Φ = 8.7 %). Taking advantage of the favorable mechanical flexibility and optical properties, Form II was used as a shapeable optical waveguide. By changing the wavelength of the light source, active or passive waveguiding can be realized. CPMBP could thus be used as a flexible wavelength filter.

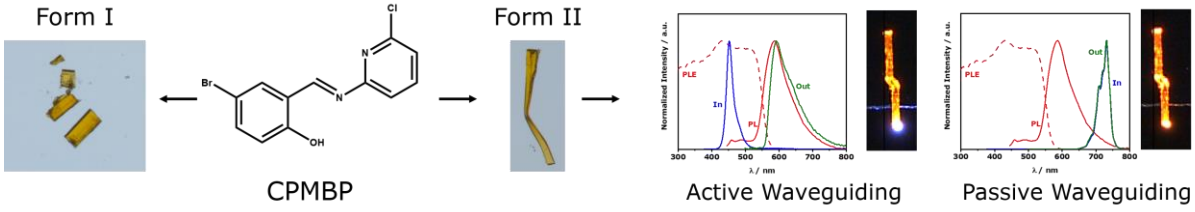

Fig. 1 CPMBP has two different polymorphs with distinct optical and mechanical properties. The mechanically plastic crystals of Form II were successfully used as optical waveguide.

1. M. Annadhasan, A. R. Agrawal, S. Bhunia, V. V. Pradeep, S. S. Zade, C. M. Reddy and R. Chandrasekar, *Mechanophotonics: Flexible Single-Crystal Organic Waveguides and Circuits*, *Angew Chem Int Ed Engl*, **59**, 13852, 2020.
2. T. Feiler, B. Bhattacharya, A. A. L. Michalchuk, S.-Y. Rhim, V. Schröder, E. List-Kratochvil and F. Emmerling, *Tuning the mechanical flexibility of organic molecular crystals by polymorphism for flexible optical waveguides*, *CrystEngComm*, **23**, 5815, 2021.