Complex Shapes of Colorful Crystals

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Single crystals having a multidomain morphology are a counterintuitive phenomenon. Growing such crystals in the lab is a great challenge, especially from organic molecules. Our pyridine-based ligands have yielded morphologies of remarkable complexity. We achieved the formation of uniform metallo-organic crystals that exhibit single crystallinity with distinct domains and chirality. The crystals have two types of continuous and chiral channels. This structural feature is atypical and has great potential for post-functionalization by selective inclusion of other components. The precise positioning and alignment of arrays of two different guest molecules in the crystalline host matrix resulted in new optically active materials. The color of individual micro-sized crystals is dependent on their relative position under polarized light. This angular-dependent behavior is a result of the geometrically constrained orientation of the dyes by the crystallographic packing. Energy transport occurs between the arrays of different dyes that are included in parallel-positioned nanochannels by Förster resonance energy transfer (FRET). Combining the anisotropic optical properties with FRET can find applications in optical switches and as bulk materials for light harvesting and up-conversion.

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