MASTER'S THESIS

Synthesis and Properties of Chiral Perovskite: from Thin Films to Single Crystals

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ABSTRACT

The urgency of decarbonization has engendered an enthusiastic pursuit of innovative photovoltaic technologies, which can achieve high power conversion efficiencies while maintaining long-term stability. In recent years, many high-performance perovskite solar cells (PSCs) have been reported to have excellent properties like low forming energy, high absorption coefficient, tunable band gap, *etc*. However, the commercialization of PSCs is hampered by several persisting scientific challenges, including mechanical and environmental stability. Mechanical stability relates to the appearance of cracks at the device interlayer arising from stress accumulation caused by applying an external mechanical force or thermal expansion. These cracks will provide pathways for perovskite degradation caused by moisture, oxygen, light, and heat, resulting in poor environmental stability of the devices. Therefore, Mechanical stability can influence the susceptibility of perovskite materials to this degradation mechanism. Chiral materials offer improved dynamic mechanical properties that benefit from their unique structural topology. This thesis aims to enhance the mechanical integrity of interfaces between the perovskite absorber layer and the electron transport layer in PSCs by introducing chiral molecules. In addition to enhancing the interface mechanical properties, it is also important to improve the tolerance of perovskite materials to environmental factors. This thesis also proposes a strategy of regulating the ratio of chiral enantiomers to regulate the environmental stability of perovskites. Specifically, we synthesized series of chiral perovskite single crystals by adding different ratios of enantiomers. Compared with single crystals with homo chirality, hetero chiral single crystals exhibit stronger environmental stability. This thesis proposes innovative concepts, using chiral molecules for durable device interface and perovskite design, would facilitate the fully explore the potential of perovskite for practical application.