A Pyrrole Modified 3,4-Propylenedioxythiophene (ProDOT) Conjugated Polymer as Hole Transport Materials for Efficient and Stable Perovskite Solar Cells

Dani, Raunak (School: West Lafayette Junior/Senior High School)

Despite the outstanding electric properties and low cost of Poly(3,4-ethylenedioxythiophene) (PEDOT) and its derivatives, their performance as hole transport layer (HTLs) materials in conventional n-i-p structure perovskite solar cells is less competitive than the widely used 2,2′,7,7′-tetrakis (N,N-di-p-methoxyphenylamine)-9,9′-spirobifluorene (Spiro-OMeTAD) or poly(triaryl amine) (PTAA), owing to their poor solubility and energy level mismatch. In this work, we report novel hole transporting materials (HTLs) based on 3,4-propylenedioxythiophene (ProDOT) for efficient perovskite solar cells (PSCs). As a result of the superior defects passivation ability, excellent contact with perovskite, improved conductivity and hole extraction process, and high hydrophobicity, the PSCs showed an impressive peak PCE of 21.49 %, along with outstanding moisture stability (over 4000 hours). This work provided the potential application of PEDOT or ProDOT-based materials as HTL for PSCs as well as shed light on the significance of the rational design of the HTL structure.