Supporting Information

Dopant-free Polymeric Hole Transport Materials for Efficient $CsPbI_2Br$ Perovskite Cells with a Fill Factor Exceeding 84%

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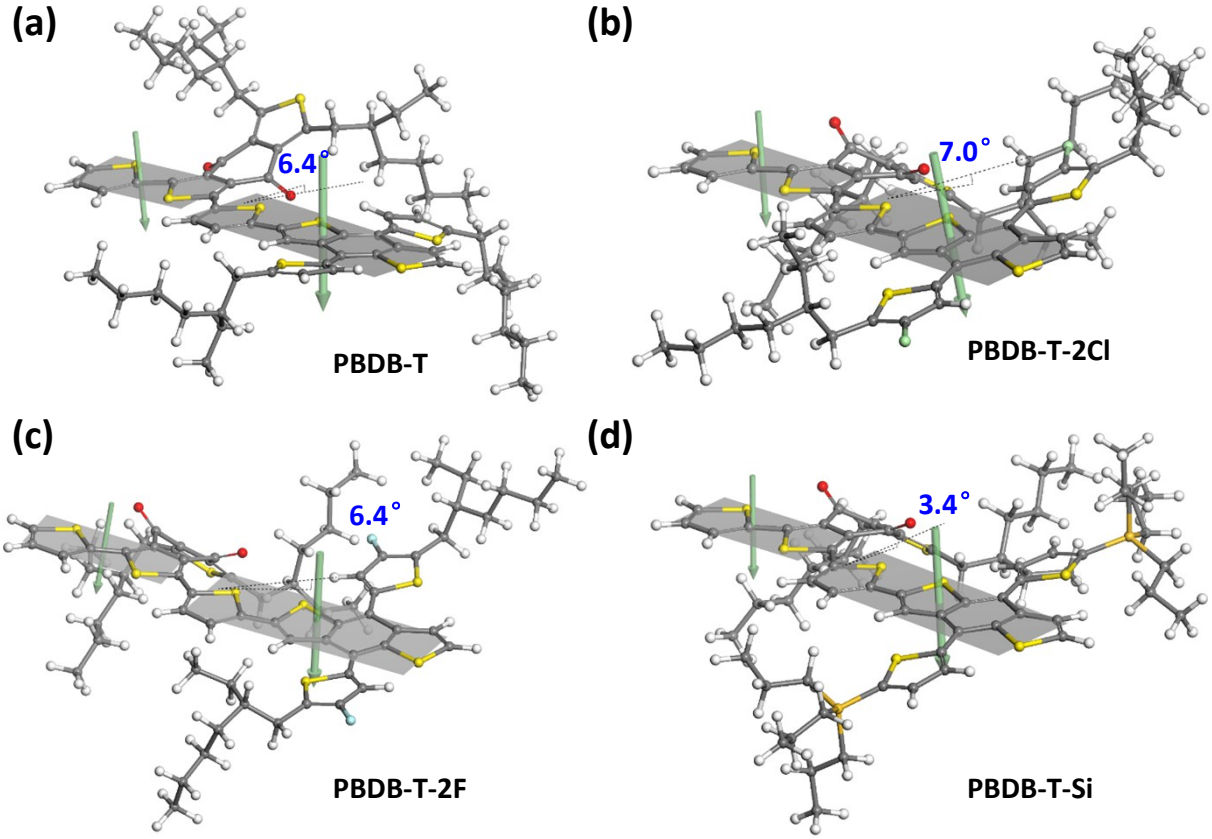

Figure S1. The dihedral angle from one repeating unit of polymeric HTMs: (a) PBDB-T, (b) PBDB-T-2Cl, (c) PBDB-T-2F and (d) PBDB-T-Si.

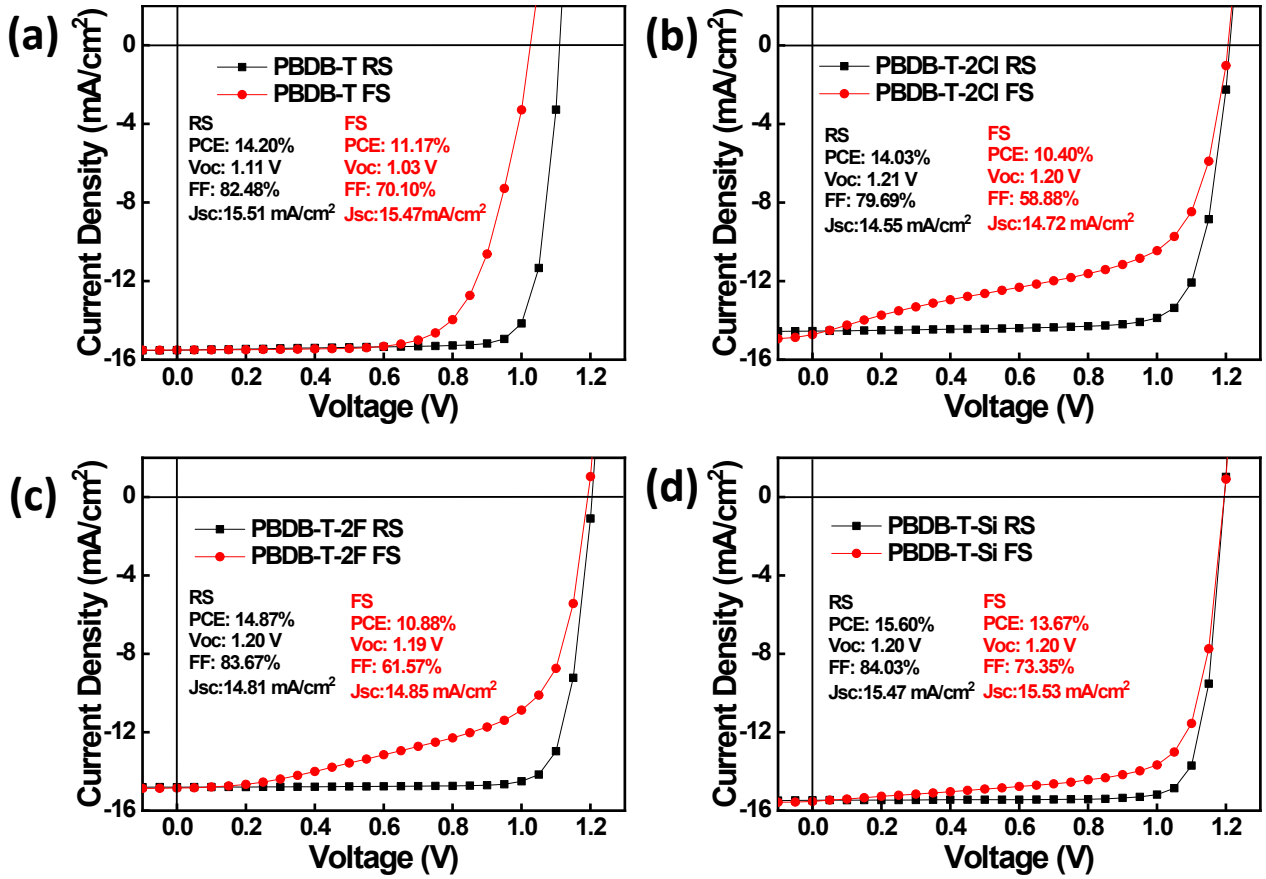

Figure S2. The best J-V curves of inorganic $CsPbI_2Br$ PSCs from forward and reverse scans using different HTMs: (a) PBDB-T, (b) PBDB-T-2Cl, (c) PBDB-T-2F, (d) PBDB-T-Si.

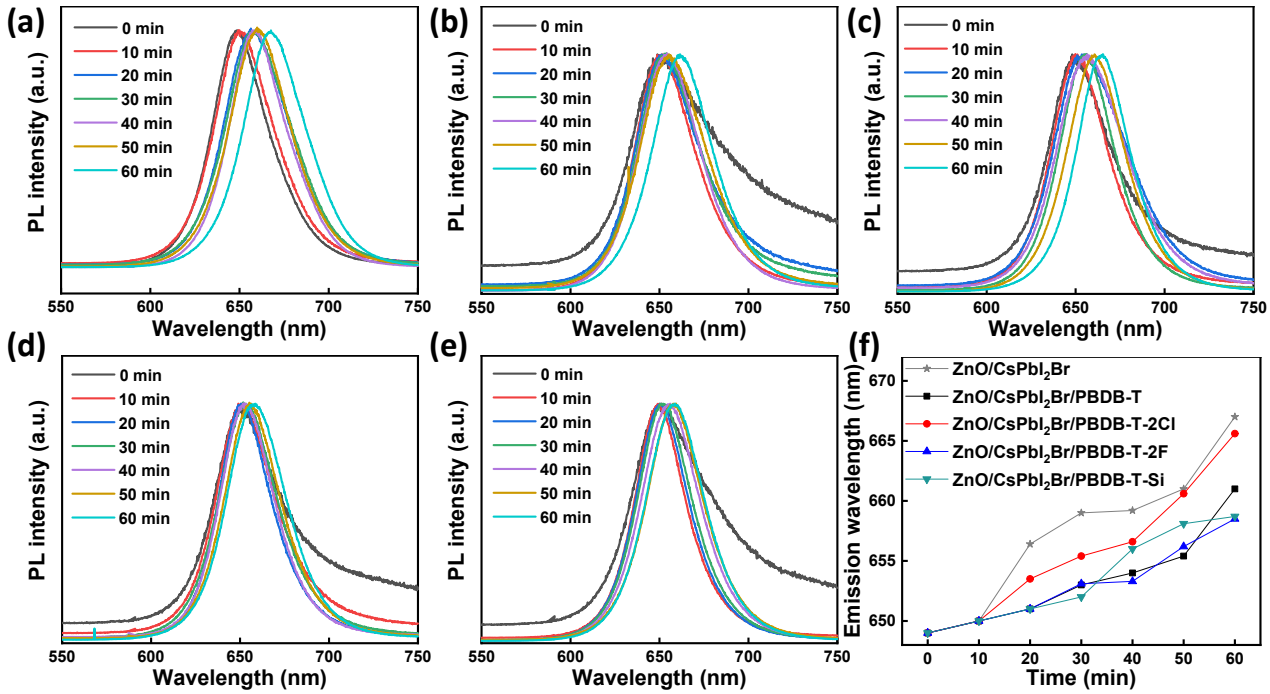

Figure S3. Steady state photoluminescence spectra of (a) ZnO/$CsPbI_2Br$, (b) ZnO/$CsPbI_2Br$/PBDB-T, (c) ZnO/$CsPbI_2Br$/PBDB-T-2Cl, (d) ZnO/$CsPbI_2Br$/PBDB-T-2F and (e) ZnO/$CsPbI_2Br$/PBDB-T-Si films upon continuous 1 sun illumination under 20-25% RH in ambient atmosphere. (f) Evolution of PL emission peak of various ZnO/$CsPbI_2Br$/HTM films.