Abstract Submitted
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Spin Hall effect in disordered organic solids ZHI-GANG YU, Applied Sciences Laboratory, Washington State University — We study the spin Hall effect (SHE) in disordered π-conjugated organic solids, where individual molecules are oriented randomly and electrical conduction is via carrier hopping. The SHE, which arises from interference between direct ($i \to j$) and indirect ($i \to k \to j$) hoppings in a triad consisting of three molecules i, j and k, is found to be proportional to $\lambda(\mathbf{n}_i \times \mathbf{n}_j + \mathbf{n}_j \times \mathbf{n}_k + \mathbf{n}_k \times \mathbf{n}_i)$, where λ is the spin admixture of π electrons due to the spin-orbit coupling and $\mathbf{n}_i$ is the orientation vector of molecule i. Electrical conductivity σ_{qq} ($q = x, y, z$) and spin-Hall conductivity $\sigma_{\rm sh}$ are computed by numerically solving the mater equations of a system containing $32 \times 32 \times 32$ molecules and summing over contributions from all triads in the system. The obtained value of spin Hall angle, $\Theta_{\rm sh} \equiv \sigma_{\rm sh}/\sigma_{qq}$, is consistent with experimental data in PEDOT:PSS, with a predicted temperature dependence as $\log \Theta_{\rm sh} \sim T^{-1/4}$.

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