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The role of exciton diffusion in the Forster-type energy transfer in hybrid organic-inorganic nanocomposites BURAK GUZELTURK, Bilkent University, PEDRO LUDWIG HERNANDEZ MARTINEZ, Nanyang Technological University and Bilkent University, DONUS TUNCEL, Bilkent University, HILMI VOLKAN DEMIR, Nanyang Technological University and Bilkent University —
The role of exciton diffusion in the Forster-type energy transfer in hybrid organic-inorganic nanocomposite is essential for devices applications. To understand the underlying interplay between the exciton transfer and exciton diffusion, we investigate the temperature dependent nonradiative energy transfer (NRET) in polymer-quantum dot (QDs) nanocomposites at high and low QD loading levels. For the low QD loading, the diffusion coefficient (D) is estimated to be greater than 1000 nm2/ns and the diffusion length (LD) is approximately 13 nm at room temperature. However, significant modifications of D and LD are observed in the case of high QD loading, where D is estimated to be 150 nm2/ns and LD is smaller than 5 nm. This suppression is attributed to the increased rates of NRET from the polymer to the QDs, with a smaller effective donor-acceptor separation at high QD loadings. In summary, the exciton diffusion plays a critical role in the resulting exciton dynamics of such polymer-QD nanocomposites, and the experimental evidence and supporting theoretical model suggest that the exciton diffusion is weak at the high loading levels when the exciton transfer dominates.

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