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Threaded molecular wires as building blocks for advanced polymer blends: WPLEDs, ultra-broadband optical amplifiers, multi color lasers SERGIO BROVELLI, MARTA MROZ, GIUSEPPE SFORAZZINI, TERSILLA VIRGILI, FRANCO MEINARDI, ALBERTO PALEARI, HARRY L. ANDERSON, GUGLIELMO LANZANI, FRANCO CACIALLI — The ability to produce semiconducting polymer blends with white emission spectra, large emission cross sections and broad optical gain is critical to their application in white PLEDs, lasers and broadband amplifiers. Cyclodextrin-encapsulation is an effective means of suppressing detrimental intermolecular interactions, and energy transfer (ET) channels in polymer blends, thus enabling fabrication of white-PLEDs. We show that all such properties combine into a high impact photonic application: ultra-broad optical gain and two-color lasing in a binary polyrotaxane blend. We study the ultrafast photophysics of a blend of a conventional and an encapsulated polyfluorene. The morphology is investigated by microRaman imaging, AFM, and fluorescence lifetime microscopy. We ascribe the ultra-broad optical gain (>850 meV), and the simultaneous ASE for both constituents, to the dual effect of reduced polaron formation and suppressed ET. Our results demonstrate that polyrotaxanes could realistically represent the building blocks for advanced polymer blends with highly controlled optical properties, for applications in solid state lightning, lasers and photovoltaic technologies.

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