

Abstract Submitted
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Residual Stresses and Photoluminescence of Conjugated Polymer Thin Films YA-WEI YANG, YI CHIEN, Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu 300, Taiwan, TSANG-LANG LIN, Department of Engineering Science and Systems, National Tsing Hua University, Hsinchu 300, Taiwan, GUNTER REITER, Institute of Physics and Freiburg Institute for Advanced Studies, Albert-Ludwigs-Universität, Freiburg, Germany, ARNOLD CHANG-MOU YANG, Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu 300, Taiwan — Molecular recoiling forces (residual stress) in ultrathin polymer films (< 100 nm) were engendered by non-equilibrium chain conformations and intermolecular packing frozen from rapid solvent evaporation during film preparation. These forces when acting on conjugated macromolecules were found to contribute to large photoluminescence (PL) enhancements. The packing of the rigid-rod macromolecules into thin solid films, however, was somewhat different from that of flexible chains. As revealed by x-ray reflectivity, although the thicknesses of the solvent-trap layer (~ 2 nm) next to substrate were almost identical, the local density was ~ 10 times less in MEH-PPV films than that in polystyrene (PS) films (20 nm). It indicates that molecular strains induced by solvent evaporation were much smaller of conjugated polymers, hinting smaller residual stresses in the films. Concomitantly, local deformations of rubber substrate under a dewetting polymer film, a good measure of the molecular recoiling forces, were considerably smaller for MEH-PPV films than for PS. The PL dependence on residual stresses of pristine MEH-PPV films hence clearly elucidates the strong molecular stress effect on optoelectronic efficiencies.

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