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Using Mass Transport to Guide the Purification of Small Molecule Organic Semiconductors via Sublimation NATHAN T. MORGAN, YI ZHANG, University of Minnesota, Minneapolis, MATTHEW L. GRANDBOIS, Engineering & Process Sciences, Core R&D, The Dow Chemical Company, BRUCE M. BELL, Analytical Sciences, Core R&D, The Dow Chemical Company, RUSSELL J. HOLMES, E. L. CUSSLER, University of Minnesota, Minneapolis — Organic electronic materials have garnered considerable commercial attention for next generation display and solid-state lighting applications. Widespread adoption of these technologies is slowed by considerable production costs, partially due to an expensive purification step. This work explores the current method of industrial purification, thermal gradient sublimation, in order to isolate the fundamental mechanisms limiting sublimation rate and controlling product deposition. For the archetypical hole transport materials, N,N'-bis(naphthalen-1-yl)-N,N'-bis(phenyl)-benzidine (NPD) and 4,4',4"-tris(carbazol-9-yl) triphenylamine (TCTA), a combination of viscous flow and physical vapor deposition are shown to be rate-limiting at constant sublimation temperature. Surprisingly, diffusion within the solid feed, reaction at the feed particle surface, and mass transfer within the bed of feed particles are not rate limiting in the case. This mechanism is different from that which is observed in many industrial sublimation systems. These results can be used to guide the design and operation of future large-scale purification systems, which are critical for the widespread adoption of organic optoelectronic devices.

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