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Tunable Molecular Orientation of Organic Semiconductors in Vapor-Deposited Amorphous Solids DIANE WALTERS, SHAKEEL DALAL, MARK EDIGER, University of Wisconsin-Madison — Amorphous solids made by physical vapor deposition (PVD) of organic molecules have found increasing use in organic LEDs and photovoltaics. PVD is favored because it allows precise control of layer thickness and high material purity, however the impact of deposition conditions on the structure of amorphous solids has been largely uninvestigated. We have previously shown that solid films prepared by PVD can have drastically higher densities, moduli and thermal stability than are obtainable by cooling the liquid. Using a high-throughput characterization technique, we show that PVD is also able to impart significant molecular orientation into amorphous solids. We present work on several common molecules used in organic semiconducting devices including AlQ₃, NPB, TPD, CBP, DSA-Ph, and BSB-Cz. The molecular orientation depends systematically on the substrate temperature during deposition. At low temperatures there is a strong tendency to lie parallel to the substrate, while at higher temperatures there is a tendency to stand vertically on end. It is anticipated, and in some limited cases has been previously shown, that this orientation can significantly affect charge mobility and light out-coupling efficiency in devices.

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