Organic heterojunctions and their roles in organic optoelectronic devices

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Organic/organic heterojunctions are the center of multilayer-structured organic optoelectronic devices, because various electronic processes, including charge injection, electron-hole recombination and dissociation, take place at or near the junctions. Most organic heterojunctions are conventionally assumed to have an aligned vacuum level and flat energy levels. While this picture is correct for some organic semiconductors, it cannot accurately account for the properties of many important organic junctions in modern organic optoelectronic devices. For example, photovoltaic devices involve junctions between organic semiconductors with highly different electron withdrawing abilities and stacked-OLEDs involve junctions between highly doped organic semiconductors. In these cases, significant charge transfer between the adjoining organic layers can lead to large band bending or electric dipole. Electronic structures of several representative organic heterojunctions in stacked OLEDs, photovoltaics and field effect transistors were studied with photoelectron spectroscopies. Working mechanisms/characteristics of these devices are then reviewed by referencing to the electronic structures of the corresponding organic heterojunctions.

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