Effect of K doping on rubrene: C$_{60}$ heterojunctions

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Using synchrotron-radiation photoemission spectroscopy, we have studied the effect of K doping on rubrene: C$_{60}$ heterojunctions. The K-doped heterointerfaces was obtained by means of C$_{60}$ on a K-rubrene surface. As the heterointerface formed, the K diffuses into the C$_{60}$ overlayer, and transfers negative charge into the lowest unoccupied molecular orbital (LUMO) of C$_{60}$, resulting in a significant interfacial dipole potential. With K doping, the creation of gap states, providing complementary absorption channels, may expand photon harvesting. Furthermore, the increase in the separation between the highest occupied molecular orbital (HOMO) of rubrene and the LUMO of C$_{60}$ could possibly be applied to increase the open circuit voltage of organic photovoltaic devices.

Interfacial energy-level diagram for C$_{60}$ on K-rubrene heterojunction.