Mechanical Properties of a Library of Low-Band-Gap Polymers - DTU Orbit (09/11/2017)

Mechanical Properties of a Library of Low-Band-Gap Polymers

The mechanical properties of low-band-gap polymers are important for the long-term survivability of roll to-roll processed organic electronic devices. Such devices, e.g., solar cells, displays, and thin-film transistors, must survive the rigors of roll-to-roll coating and also thermal and mechanical forces in the outdoor environment and in stretchable and ultraflexible form factors. This paper measures the stiffness (tensile modulus), ductility (crack-onset strain), or both of a combinatorial library of 51 low-band-gap polymers. The purpose of this study is to systematically screen a library of low-band-gap polymers to better understand the connection between molecular structures and mechanical properties in order to design conjugated polymers that permit mechanical robustness and even extreme deformability. While one of the principal conclusions of these experiments is that the structure of an isolated molecule only partially determines the mechanical properties another important codeterminant is the packing structure some general trends can be identified. (1) Fused rings tend to increase the modulus and decrease the ductility. (2) Branched side chains have the opposite effect. Despite the rigidity of the molecular structure, the most deformable films can be surprisingly compliant (modulus >= 150 MPa) and ductile (crack-onset strain

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