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Bio-inspired peptide nanostructures for organic field-effect transistors[1] GRANT KNOTTS, Univ of Missouri - Columbia, THIAGO CIPRIANO, Universidade Federal do ABC, AMRIT LAUDARI, Univ of Missouri - Columbia, ROBERTA BIANCHI, WENDEL ALVES, Universidade Federal do ABC, SUCHI GUHA, Univ of Missouri - Columbia — Peptide-based nanostructures derived from natural amino acids are superior building blocks for biocompatible devices as they can be used in a bottom-up process without the need for expensive lithography. A dense nanostructured network of L,L−diphenylalanine (FF) was synthesized using the solid-vapor phase technique. The formation of the nanostructures and structure-phase relationship were investigated by electron microscopy and Raman scattering. Thin films of L,L−diphenylalanine micro/nanostructures (FF-MNSs) were used as the dielectric layer in pentacene-based field-effect transistors (FETs) and metal-insulator-semiconductor diodes both in bottom-gate and top-gate structures. Bias-stress studies show that FF-MNS based pentacene FETs are more resistant to degradation than pentacene FETs using FF thin film (without any nanostructures) as the dielectric layer when both are subjected to sustained electric fields. Furthermore, it is demonstrated that the FF-MNSs can be functionalized for detection of enzyme-analyte interactions. This work opens up a novel and facile route towards scalable organic electronics using peptide nanostructures as scaffolding and as a platform for biosensing.

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