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Photophysical characterization of semiconductive protein based biofibers

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Thiophene-based compounds represent one of the most promising class of materials studied in organic electronics and bioelectronics. The introduction of dioxide moieties at the sulfur atom in poly- and oligothiophenes allows for a wide tuning of their optical and electronic properties and renders the molecules' behavior highly dependent on the surrounding environment [1].
Living cells can be employed as a polymerization platform for monomer, leading to the formation of a bio-hybrid structure in which cell produced protein works as a scaffold for fibrils fabrication.
Here, we report about the cell-mediated assembly of semiconductive nanofibers based on dithienothiophene-S,S-dioxide (DTTO) derivatives [2]. We fully characterized the structure and the photophysics of the realized fibers through steady state and time-resolved spectroscopy. We report the presence of DTTO aggregates inside the fibers, which represent the conductive domains of the nanostructured material [3] and describe the interaction between DTTO molecules and the protein scaffold. The fibers' conductive behavior, together with the energy transfer between molecules can be exploited to directly stimulate cells in contact with the fibers or to electrically connect different cells. Further studies of the fibers' structure and production process are in progress, with the aim to open the way to a wide range of new protein-based materials for bioelectronics and cell photostimulation.

References

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