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Coupling synthetic biology and programmable materials to construct complex tissue ecosystems

Catherine S. Millar-Haskell, Allyson M. Dang, Jason P. Gleghorne

The investigation of biological systems with programmable features stems from the need to systematize the iteration of *de novo* synthetic biology methods or investigation of new phenomena in an accelerated fashion. However, it is important to relate this to the statistical analysis of population within cultured organisms to provide for tight correlation of experimentation and phenomenological interpretation. This review gives an important overview of this emerging field. https://doi.org/10.1557/mrc.2019.69

On the thermal processing and mechanical properties of 3D-printed polyether ether ketone (PEEK)

Russell Wang, Kang-Jie Cheng, Rigoberto C. Advincula, Qiyi Chen

There is a lot of interest in high-performance polymers (HPP) including polyether ether ketone (PEEK) for 3D printing because of properties that can rival metals. In addition, there is interest in using these materials for biomaterials and bio-implant application. This work focuses on highlighting the importance of achieving balance with the crystalline and amorphous domains formed during the layer deposition for optimization of thermomechanical properties.

https://doi.org/10.1557/mrc.2019.86

Artificial neural network correction for density-functional tight-binding molecular dynamics simulations

Junmian Zhu, Van Quan Vuong, Bobby Sumpter, Stephan Irle

This work highlights the use of machine learning and artificial neural networks (NN) to optimize properties of molecular systems involving non-covalent interaction forces. The comparison with typical density functional theory (DFT) methods vs. the application NN in a DFTB-NN approach results in faster optimization methods. Eventually, this approach can be used for more complex molecular and even macromolecular systems. https://doi.org/10.1557/mrc.2019.80

Synthesis and characterization of ionene-polyamide materials as candidates for new gas separation membranes

Jason E. Bara, Kathryn E. O'Harra, Marlow M. Durbin, Grayson P. Dennis, Enrique M. Jackson, Brian Thomas, Jamiu A. Odutola

Bara and co-authors describe the fabrication of several thermoplastic materials to be used for gas separation membranes. Molecular weights helped identify the likely limiting step in the polymerization. The characterization of thermal properties allowed for subsequent melt processing. One ionene behaves elastomerically, suggesting particularly attractive performance for a separation membrane. https://doi.org/10.1557/adv.2018.376

Enhanced grain size and crystallinity in $CH_3NH_3PbI_3$ perovskite films by metal additives to the single-step solution fabrication process

Zahrah S. Almutawah, Suneth C. Watthage, Zhaoning Song, Ramez H. Ahangharnejhad, Kamala K. Subedi, Niraj Shrestha, Adam B. Phillips, Yanfa Yan, Randy J. Ellingson, Michael J. Heben

This paper provides a route to increasing the performance of perovskite photovoltaic devices by demonstrating that the concentration of Cd or Zn in a perovskite precursor solution can control the grain size and relative crystallinity of MAPbI films. The structures lead to enhanced photoluminescence over finer grained films.

https://doi.org/10.1557/adv.2018.413

Freeze-cast porous chitosan conduit for peripheral nerve repair

Kaiyang Yin, Prajan Divakar, Jennifer Hong, Karen L. Moodie, Joseph M. Rosen, Cathryn A. Sundback, Michael K. Matthew, Ulrike G.K. Wegst

A foam-like chitosan scaffold with bi-directional porosity is shown to be mechanically robust and suitable for enhancing nerve cell growth. Animal model testing demonstrated that the material has promise for recovery treatments, and the mechanical flexibility and elasticity of the scaffold is viewed as a positive feature for surgical implantation. https://doi.org/10.1557/adv.2018.194

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