Ilja Czolkos - Publications - DTU Orbit (31/01/2016)

Platform for Controlled Supramolecular Nanoassembly

We here present a two-dimensional (2D) micro/nano-fluidic technique where reactant-doped liquid−crystal films spread and mix on micro- and nanopatterned substrates. Surface-supported phospholipid monolayers are individually doped with complementary DNA molecules which hybridize when these lipid films mix. Using lipid films to convey reactants reduces the dimensionality of traditional 3D chemistry to 2D, and possibly to 1D by confining the lipid film to nanometer-sized lanes. The hybridization event was observed by FRET using single-molecule-sensitive confocal fluorescence detection. We could successfully detect hybridization in lipid streams on 250 nm wide lanes. Our results show that the number and density of reactants as well as sequence of reactant addition can be controlled within confined liquid crystal films, providing a platform for nanochemistry with potential for kinetic control.

General information

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Authors: Czolkos, I. (Intern), Hannestad, J. K. (Ekstern), Jesorka, A. (Ekstern), Kumar, R. (Ekstern), Brown, T. (Ekstern), Albinsson, B. (Ekstern), Orwar, O. (Ekstern)
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Platform for Controlled Supramolecular Nanoassembly

General information

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Controlled release of chol-TEG-DNA from nano- and micropatterned SU-8 surfaces by a spreading lipid film
We report the controlled release of immobilized cholesteryl- tetraethyleneglycol-DNA (chol-DNA) from micropatterned SU-8 surfaces by a spreading lipid film. The release of chol-DNA is rapid and on the order of the spreading rate of the lipid film β = 1-3 μ2/s (~M 5 molecules of DNA per second). The lipid film serves as a poor solvent for the DNA adduct, which upon contact redistributes into the aqueous phase. Thus, the release of DNA is accompanied by a change in surface hydrophobicity. The method can be used for creating arbitrary concentration profiles of DNA in solution over time or to dynamically change surface properties on demand in, for example, micro- and nanofluidic devices. Examples of DNA release from spiral, comb, meander, and triangular as well as from nanoscale SU-8 lanes are shown. © 2008 American Chemical Society.

General information
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Authors: Erkan, Y. (Ekstern), Halma, K. (Ekstern), Czolkos, I. (Intern), Jesorka, A. (Ekstern), Dommersnes, P. (Ekstern), Kumar, R. (Ekstern), Brown, T. (Ekstern), Orwar, O. (Ekstern)
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Controlled formation and mixing of two-dimensional fluids

We introduce a novel technique for the controlled spreading and mixing of lipid monolayers from multilamellar precursors on surfaces covered by the hydrophobic epoxy resin SU-8. The lipid spreads as a monolayer as a result of the high surface tension between SU-8 and the aqueous environment. A micropatterned device with SU-8 lanes, injection pads, and mixing regions, surrounded by hydrophilic Au, was constructed to allow handling of lipid films and to achieve their mixing at controlled stoichiometry. Our findings offer a new approach to dynamic surface functionalization and decoration as well as surface-based catalysis and self-assembly. © 2007 American Chemical Society.

General information

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