Analytical Instrumentation, Methods & Materials

Devices and Methods for Immobilizing Liquid Crystal Droplets onto a Chemically Functionalized Substrate Surface

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WARF: P100260US02

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing structures and methods for the polymer-facilitated immobilization of liquid crystal droplets on chemically functionalized solid surfaces.

Overview

Liquid crystal materials are promising candidates for many sensing and interfacial applications. Liquid crystals respond to and amplify small changes in temperature, electric or magnetic fields, shear or structure at the interface where they contact another material. They serve as “molecular magnifying glasses,” allowing events that occur at the nanoscale to be observed by the naked eye. This aspect of liquid crystal-based systems has been used previously to develop new sensing platforms that can indicate the presence or organization of chemical or biological agents (e.g., see WARF reference numbers P08443US02 and P09241US02).

Typical liquid crystal-based systems consist of either planar interfaces between liquid crystals and an aqueous solution or liquid crystal droplets dispersed within an aqueous phase. In the latter, droplet mobility is often desirable; however, situations exist in which immobilized droplets are preferred.

The Invention

UW–Madison researchers have developed devices and methods for immobilizing micrometer-sized liquid domains such as liquid crystal or isotropic oil droplets on a variety of chemically-functionalized surfaces. A multifunctional polymer, which may be a polyamine, is adsorbed at the surface interface of the liquid crystal droplets. Then the droplets are immobilized by covalent bonding, electrostatic interactions or other interactions between the adsorbed polymer and the functionalized substrate surface. The immobilized droplets can be used, for example, in liquid crystal droplet-based sensing devices or devices engineered to possess optical band gaps.

Applications

- Liquid crystal droplet-based sensing devices for detecting bacteria, viruses, phospholipids, surfactants, polymers or proteins
- Tunable arrays or displays with dynamic optical properties, including devices with optical band gaps

Key Benefits

- Enables immobilization of liquid crystal droplets on surfaces
- Immobilized droplets are still capable of undergoing detectable changes in orientation in response to stimuli.
- Ability to tailor both the chemically functionalized surface and the polymer functionality enables permanent (covalent bonding) or
- Immobilization of
- May be used for spatially or temporally controlling the release or production of a compound of interest

- May be used for the “layer-by-layer” fabrication of a composite material at an interface
- Also applicable to droplets of isotropic liquids

Additional Information

Related Technologies

- WARF reference number P08443US02 describes mechanically robust, self-supporting and moldable liquid crystal-containing gels that respond to chemical and biological species in gas or liquid phases.
- WARF reference number P09241US02 describes liquid crystal-based sensors that can be used to detect the presence of endotoxin.

Publications

- Kinsinger M.I., Buck M.E., Abbott N.L. and Lynn D.M. 2010. Immobilization of Polymer-Decorated Liquid Crystal Droplets on Chemically Tailored Surfaces. Langmuir. 26, 10234-10242.

Tech Fields

- Analytical Instrumentation, Methods & Materials : Sensors
- Research Tools : Detection

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867