Automated System Measures Changes in Liquid Crystal Orientation to Detect and Quantify Biomolecules

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OVERVIEW

Liquid crystals provide a means of detecting the presence of target molecules, such as peptides and proteins, on surfaces. Current methods work by detecting a change in the orientation of liquid crystals in the presence or absence of the target analyte. However, these methods largely are qualitative.

The inventors previously developed an alternative means of measuring target molecules by detecting differences in the anchoring strength of liquid crystals (see WARF reference number P05453US). This method is more reproducible, sensitive and quantitative than current methods.

THE INVENTION

UW-Madison researchers now have developed an automated system for precisely determining the in-plane orientation of liquid crystals with high spatial resolution to sensitively and quantitatively detect biomolecules. This system, which allows variations in the anchoring strength of liquid crystals to be measured easily, consists of a modified liquid crystal cell and an automated image recording and analysis system.

The liquid crystals can be oriented by a variety of mechanisms. In one embodiment, a liquid crystal cell is composed of two functionalized thin films of gold, which face each other and are separated by a mylar spacer. One surface orients the liquid crystal with an in-plane anchoring, which is not parallel to the in-plane anchoring of the opposing surface.

Then a series of images are acquired of the liquid crystal film that contacts the surface to be analyzed. The images are analyzed to yield maps of the twist angle and thus anchoring energy of the liquid crystal across the surface. This technique effectively condenses a large data set of images into a compact map to reveal features on the analytic surface that were not apparent in the individual images.
APPLICATIONS

- Detection of liquid crystal-based readouts, including readouts of arrays
- Detection of biomolecules, including DNA, proteins and peptides
- Analysis of surfaces for imperfections or desired chemistry patterns

KEY BENEFITS

- Provides improved detection of liquid crystal readouts
- Capable of characterizing spatial variation in surface chemistry with a resolution greater than 10 μm
- Suitable for high throughput analysis
- Precisely determines in-plane liquid crystal orientation on reference and analyte surfaces at all points simultaneously
- Retains spatial information of regions where twisted states of liquid crystals are different
- Enables simple, rapid and versatile analysis of surfaces
- Allows full automation of image acquisition and liquid crystal analysis to provide a complete analysis instrument
- Can be used to quantify biomolecule adsorption with high sensitivity and resolution
- Eliminates need to label target molecules with radioactive or fluorescent probes

ADDITIONAL INFORMATION

Related Technologies

Tech Fields
Research Tools - Detection
Analytical Instrumentation - Liquid crystals

CONTACT INFORMATION

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854.

FIGURES

Components of the automated analysis system.