immersed. The advantage of this cuvette 220 is the possibility of fast changing the substrate 206 together with keeping all other parts of the system stable. Thus when a next substrate (not shown) is immersed, the system is ready for the next measurement. However liquid flow pattern is complicated because the inlet 222 and the outlet 224 are introduced from the top of the cuvette 220. Hence a magnetic stirrer 227 is required to achieve uniformity of the solution, and hence it is suitable to measure only slow kinetics, e.g. in the range of minutes.

[7] Another optical technique for measurement of molecular binding is surface plasmon resonance (SPR), which is shown in Figure 3. SPR relies on a measurement of refractive index change at a metal surface, when molecules attach to the surface. It works as follows: light 304 enters through a transparent substrate 306 at incidence angle θ_{SPR}. The light 304 induces plasmon resonance in a gold (Au) layer 315; deposition of the layer 313 changes the value of the resonance angle. If incidence angle θ_{SPR} is fixed, it changes reflected intensity. Because surface plasmon wave is evanescent in the direction normal to the surface and propagates along the surface, it is very sensitive to the molecules near the surface and less sensitive to molecules far from the surface, or changes in the medium. However, SPR only works with noble metals (mostly gold), which limits the range of applications of this measurement technique.

[8] There is thus a need to address the shortfalls of the measurement techniques described above.

Summary of Invention

[9] According to one aspect of the invention, there is provided an ellipsometry system for measuring any one or more of molecular binding, adsorption and desorption on a substrate, the system comprising: a) a cuvette comprising i) a body within which a cavity is formed and an opening on the body, wherein the cavity extends into the opening through which the substrate is immersed; ii) a window formed on each of two oppositely located walls of the body, wherein the windows are aligned to allow light to enter through one of the two windows to reflect off the portion of the substrate immersed in the cavity and exit through the other of the two windows; iii) a channel arrangement enclosed within the body of the cuvette and comprising two non-contiguous portions, wherein one of the two non-contiguous portions guides fluid into the cavity and the other non-contiguous portion guides fluid out of the cavity; b) a polarized light source disposed to provide the light that enters into one of the two windows on the body of the cuvette; and c) a detection stage disposed to receive the light that exits through the other of the two windows on the body of the cuvette, wherein the detection stage is configured to measure polarization rotation of the received light, the polarization rotation caused by any one or more of molecular binding, adsorption and desorption occurring on the substrate surface. The detection stage preferably contains a polarisation modulator, which is configured to measure polarization rotation of the received light. The cuvette further comprises a fluid inlet and a fluid outlet formed on the body, wherein the fluid inlet and the fluid outlet are in fluid communication with the channel arrangement; wherein the channel arrangement comprises: an input conduit that is coupled at one end to the fluid inlet and coupled to the cavity at the other end; and an output conduit that is coupled at one end to the fluid outlet and coupled to the cavity at the other end; wherein the input conduit comprises two

branches, wherein each of the two branches has one end that meets at a common region for coupling to the fluid inlet and the other end is coupled to opposite corners of the cavity.

Brief Description of Drawings

Claims

[Claim 1] An ellipsometry system for measuring any one or more of molecular binding, adsorption and desorption on a substrate, the system comprising

a) a cuvette comprising

i) a body within which a cavity is formed and an opening on the body, wherein the cavity extends into the opening through which the substrate is immersed;

ii) a window formed on each of two oppositely located walls of the body, wherein the windows are aligned to allow light to enter through one of the two windows to reflect off the portion of the substrate immersed in the cavity and exit through the other of the two windows;

iii) a channel arrangement enclosed within the body of the cuvette and comprising two non-contiguous portions, wherein one of the two non-contiguous portions guides fluid into the cavity and the other non-contiguous portion guides fluid out of the cavity;

b) a polarized light source disposed to provide the light that enters into one of the two windows on the body of the cuvette; and

c) a detection stage disposed to receive the light that exits through the other of the two windows on the body of the cuvette, wherein the detection stage is configured to measure polarization rotation of the received light, the polarization rotation caused by any one or more of molecular binding, adsorption and desorption occurring on the substrate surface;

wherein the cuvette further comprises a fluid inlet and a fluid outlet formed on the body, wherein the fluid inlet and the fluid outlet are in fluid communication with the channel arrangement;

wherein the channel arrangement comprises: an input conduit that is coupled at one end to the fluid inlet and coupled to the cavity at the other end; and an output conduit that is coupled at one end to the fluid outlet and coupled to the cavity at the other end;

wherein the input conduit comprises two branches, wherein each of the two branches has one end that meets at a common region for coupling to the fluid inlet and the other end is coupled to opposite corners of the cavity.

[Claim 2] The ellipsometry system of claim 1 wherein the input conduit extends into the cavity by going around a segment of the portion of the substrate immersed in the cavity.

[Claim 3] The ellipsometry system of claims 1 or 2, wherein the cuvette further comprises a support structure adapted to hold the substrate with at least a portion immersed in the cavity.

[Claim 4] The ellipsometry system of claim 3, wherein the support structure has a surface that receives the substrate and an opposite surface that faces the input conduit of the channel arrangement.

[Claim 5] The ellipsometry system of claim 4, wherein the support structure comprises a biasing element that urges the substrate against the receiving surface of the support structure.

[Claim 6] The ellipsometry system of claim 5, wherein the biasing element comprises any one or more of a leaf, a screw and a clip.

[Claim 7] The ellipsometry system of any one of the preceding claims, further comprising a pump coupled to the fluid outlet of the body of the cuvette.

[Claim 8] The ellipsometry system of any one of the preceding claims, wherein the body of the cuvette further comprises a reagent inlet that extends into the channel arrangement which is in fluid communication with the fluid inlet.

[Claim 9] The ellipsometry system of any one of the preceding claims, wherein the opening, the fluid inlet and the fluid outlet are located on different surfaces of the body of the cuvette.

[Claim 10] The ellipsometry system of any one of the preceding claims, wherein the detection stage comprises:

i) a retarder disposed in the path of the received light for polarization state conversion of the received light;

ii) a polarizer disposed to receive light transmitted through the retarder, the transmitted light having been converted into a polarization state suitable for the polarizer by the retarder;

iii) a detector disposed downstream of the polarizer to receive light transmitted through the polarizer; and

iv) a drive mechanism coupled to the polarizer to modulate the polarization of the light transmitted through the retarder, the drive mechanism configured to move the polarizer within a plane generally perpendicular to the direction of the received light.

[Claim 11] The ellipsometry system of claim 10, wherein the drive mechanism comprises an actuator coupled to the polarizer, wherein the actuator is configured to apply rotational motion to the polarizer along an arc that lies in the plane.

[Claim 12] The ellipsometry system of claim 11, wherein the actuator is coupled to the polarizer through an elastic element.

[Claim 13] The ellipsometry system of claim 11, wherein the polarizer is suspended on a plurality of elastic elements spatially arranged to be each equally spaced apart.

[Claim 14] The ellipsometry system of claim 13, wherein the drive mechanism further comprises at least one further actuator, each coupled to one of the plurality of elastic elements, wherein the plurality of actuators are configured to oscillate the polarizer within the plane generally perpendicular to the direction of the received light.

[Claim 15] The ellipsometry system of claim 14, wherein the drive mechanism further comprises: a sensor coupled to at least one of the plurality of elastic elements; and the detection stage further comprises a tuning circuit coupled to the sensor and the plurality of elastic elements, wherein the tuning circuit provides a driving signal to have the plurality of actuators operate at resonance frequency in response to a signal received from the sensor.

[Claim 16] The ellipsometry system of any one of the claims 11 to 15, wherein the actuator comprises any one or more of a piezo-electric and a bimetallic strip.

[Claim 17] The ellipsometry system of any one of the claims 10 to 16, wherein the drive mechanism comprises a platform coupled to the polarizer, wherein the platform is

arranged to rotate around an axis that is generally parallel to the path of the received light, so that the rotating platform is configured to rotate the polarizer on the plane.