sample stage). The fluid medium is selected for having a higher index of refraction than air, which increases the numerical aperture (NA) of the inverted microscope objective, thereby increasing the resolution of the inverted microscope as compared to imaging in air. Thus, such high NA optical systems depend upon the integrity of physical contact of the fluid medium between the inverted microscope objective and the sample focal plane for high throughput imaging.

[0005] An example of inverted microscopy is provided by U.S. Patent No. 8,199,407 B2, issued on June 12, 2012, entitled "Immersion Object, Apparatus for Forming an Immersion Film and Method," which is hereby incorporated by reference as if fully set forth herein.

SUMMARY

[0005a] In an aspect, the present disclosure provides a method for inverted immersion microscopy, the method comprising:

using a microscope objective to image a first sample included in a plurality of samples, wherein the microscope objective is adapted to be immersed in a fluid at a distal portion of the microscope objective, wherein the microscope objective further comprises:

a sensor ring coupled to the distal portion and forming an annulus, and wherein the sensor ring further comprises:

a plurality of sensor electrodes, wherein each sensor electrode of the plurality of sensor electrodes is adapted to remain in contact with the fluid when the fluid immerses the microscope objective;

a common electrode that is adapted to remain in contact with the fluid when the fluid immerses the microscope objective; and

a fluid port to replenish the fluid; and

using an immersion controller coupled to the plurality of sensor electrodes and the common electrode to maintain the fluid over an optical axis diameter of the distal portion of the microscope objective.

[0005b]In an aspect, the present disclosure provides a control system for fluid immersion for inverted microscopy, the control system comprising:

a sensor ring coupled to a distal portion of a microscope objective used with an inverted microscope, wherein the sensor ring forms an annulus enabled to convey a fluid that forms an immersion layer at a surface of the microscope objective during imaging using the microscope objective, and wherein the sensor ring further comprises:

a plurality of sensor electrodes, wherein each sensor electrode of the plurality of sensor electrodes is adapted to remain in contact with the fluid when the fluid immerses the microscope objective;

a common electrode that is adapted to remain in contact with the fluid when the fluid immerses the microscope objective; and

a fluid port to receive additional fluid to replenish the immersion layer; and

an immersion controller coupled to the plurality of sensor electrodes and the common electrode, the immersion controller enabled to maintain the fluid over an optical axis diameter of the distal portion of the microscope objective.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] For a more complete understanding of the present invention and its features and advantages, reference is now made to the following description, taken in conjunction with the accompanying drawings, in which:

[0007] FIGURE 1 depicts selected elements of an inverted microscope system;

[0008] FIGURE 2 depicts selected elements of a fluid immersion control system;

[0009] FIGURE 3 depicts selected elements of a measurement circuit;

[0010] FIGURE 4 depicts a prior art inverted microscope objective in motion;

[0011] FIGURE 5 depicts an inverted microscope objective with immersion fluid control in motion;

[0012] FIGURE 6 depicts details of a sensor ring mounted to a microscope objective;

[0013] FIGURE 7 depicts a top view of a sensor ring in detail;

[0014] FIGURE 8 depicts a bottom view of a sensor ring in detail;

[0015] FIGURE 9 depicts further details in a sectional view of a sensor ring;

[0016] FIGURE 10 depicts further details in a sectional view of a sensor ring mounted to a microscope objective;

[0017] FIGURE 11 depicts a working distance in a sectional view of a sensor ring mounted to a microscope objective;