Supplementary material for :

A smartphone-based chip-scale microscope using the sunlight illumination

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Figure S1. Shadow images of the reference target under the indirect (room light with multiple lamps) and direct illumination (under a flashlight). The target (cross-mark) is 200 μ m × 200 μ m in size.



Indirect illumination

Direct illumination



Figure S2. Microsphere (2.5um and 1.75um) images taken under various illumination sources. Under (a) LED flashlight in a smartphone, (b) Fluorescent light bulb (compact type, 15W) and (c) sunlight (clear sky, 2pm). For all experiments, we placed an IR filter and a ND filter (2OD) above the image sensor. For (a) and (b), images were taken at 30 cm away from the light source.



Figure S3. Microsphere images taken under different scanning motion. (a) Careful x, y scanning by monitoring the target tracing results, and (b) Random scanning by continuously tilting the device without target tracing. Insets show the tracing results. Both images were taken under sunlight illumination.



Figure S4. Blood smear images taken under various illumination sources. Under (a) sunlight (clear sky, 2pm), (b) Fluorescent light bulb (Spiral type, 15W) and (c) LED flashlight in a smartphone. For all experiments, we placed an IR filter and a ND filter (2OD) above the image sensor. For (b) and (c), images were taken at 30cm away from the light source.



Sunlight

Fluorescent lamp

LED flashlight

Movie M1. Construction of smartphone-based on-chip microscope. The back camera module of a Samsung Galaxy S4 device is modified by removing the lens module. We replace the camera module with the modified image sensor.

Movie M2. Portable imaging of freshwater sample using our chipscale microscope.