

Off-null ellipsometer based on smartphone platform

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In this research we have designed and constructed the first off-null ellipsometer based on smartphone platform. The principle design of this ellipsometer is configured to use a smartphone screen as a light source and front phone camera as a detector. Thus the configuration of the optical coupler is necessary to collect a parallel beam of linearly polarized light from a phone screen and direct it to sample surface. The reflected light from the sample surface passes through the analyzer and the coupler projects the ellipsometric image to the front camera of the phone. So that it is necessary to develop the mobile phone application, which can display images on phone screen as the light source and take the picture of the measurements simultaneously. The obtained images are analyzed by calculating the average intensity in the red color channels of the front camera for a predefined region of interest. Moreover, microfluidic channels, adhered on the top of chip sensor (Optislide), is used for the flowing of liquid sample to study the adsorption of solution on liquid/solid interface based on the change of the polarization state of the reflected light. Calibrations are carried out with ethanol solutions of four mass concentrations of 0, 10, 20 and 30%. As a result, the off-null ellipsometric intensity, which is analyzed from pictures, and the mass concentration values are linearly dependent. From this work, the smartphone-based off-null ellipsometer combined with microfluidic channel allows investigating several fluid compositions on liquid/solid interface in parallel.

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