내부 전반사 결상 타원계측법을 이용한 생체시료의 동특성 측정

Total internal reflection ellipsometry for biomolecular kinetics analysis

제갈원, 조현모, 조용재
한국표준과학연구원 전략기술연구부
wchegal@kriss.re.kr

A total internal reflection ellipsometry (TIRE) with a PDMS (poly-dimethylsiloxane) molded multi-channel microfluidic system has been developed for kinetic analysis of biomolecular interactions. In comparison with the conventional surface plasmon resonance reflectometry based on angular interrogation, wavelength interrogation, and intensity measurement scheme, the TIRE has superior sensitivity down to 1×10^{-7} RIU (refractive index unit) with the help of measuring phase information carried on ellipsometric parameter, Δ. The PDMS microfluidic chips were fabricated by soft lithography technique. The microfluidic chips have 4 flow stream channels in which the channel widths are about 70 μm. By using a commercial single wavelength imaging ellipsometer, ellipsometric parameters were measured during injecting solutions with different concentrations of ethylene glycol (EG) into each microfluidic channels. When pure EG solution is mixed in distilled water the injected solutions with different concentrations of EG are made by varying the volume fraction of the pure EG solution to the distilled water. The EG volume fractions in the injected solutions are correlated with their refractive indices measured by using the Abbe refractometer. The resolutions and sensitivities of TIRE measurements were evaluated for each case of ellipsometric angles Ψ and Δ, respectively. The evaluation results show that great enhancement of measurement resolution could be acquired in the case of Δ. It is noted that the differences of Δ values of the injected solutions with different EG volume fractions from that of the distilled water has a good linear characteristic up to the EG volume fraction of 20 % as shown in Figure. It is expected that the TIRE with the multi-channel microfluidic system could be used for small molecular detection or high throughput screening process for biomolecular kinetics analysis due to its intrinsic high sensitivity.

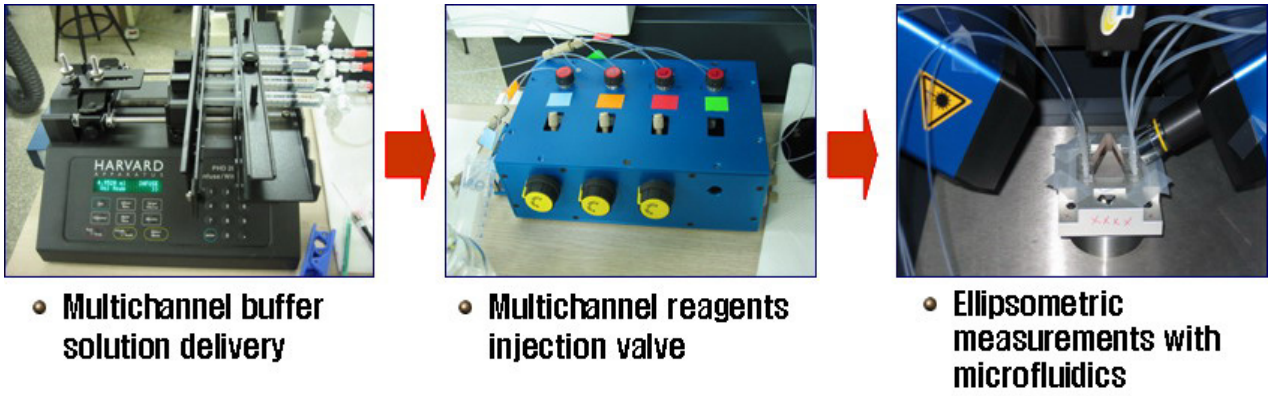

Figure : Total internal reflection ellipsometry system, (a)multi-channel buffer solution delivery system, (b)multi-channel reagents injection valves, and (c)single wavelength imaging ellipsometer

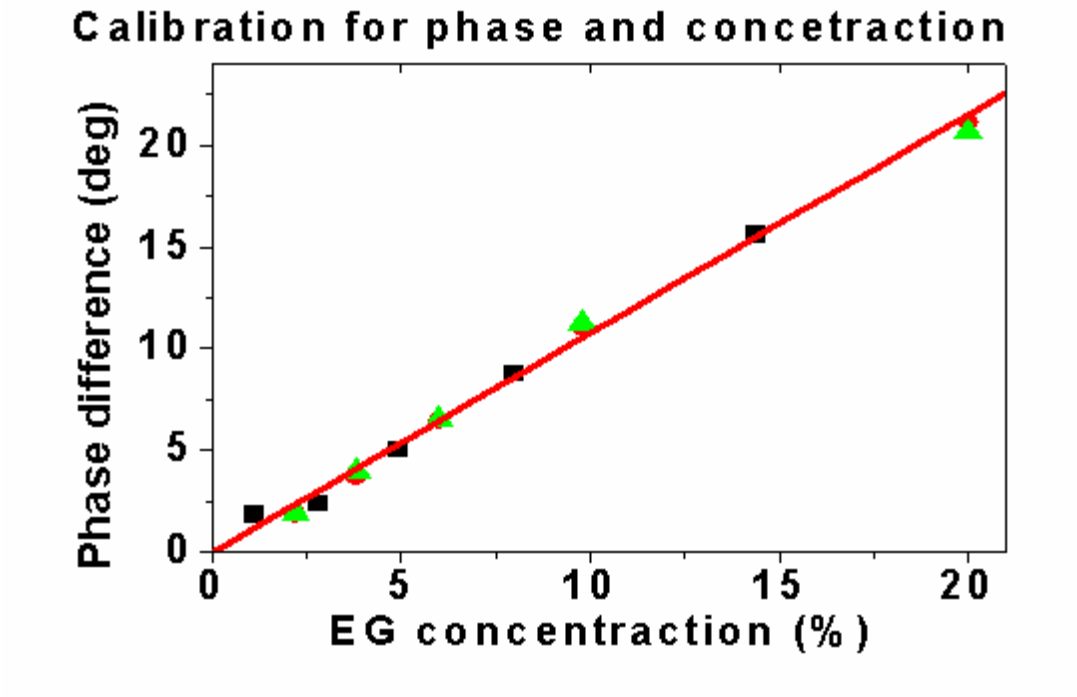

Figure : Ellipsometric parameter, Δ measurements during injection of ethylene glycol (EG) solutions. Square symbols denote differences of values measured for injected solutions with different ethylene glycol volume fractions from that for the distilled water and a red line is obtained by linear fitting.