Effect Of The Immersion Angle Of A One-Face Sealed Quartz Crystal Microbalance In Electrolytic Solution

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When the Quartz crystal microbalance (QCM) is dipped into a liquid, the oscillating frequency depends on a liquid viscosity. Several pioneering articles to theoretically describe this phenomenon appeared. In those articles, the study of Kanazawa and Gordon is most supported in a Newtonian liquid. However, many attempts profiles only that their theory holds qualitatively.
Recently, in a Newtonian liquid, we have found that the resonant frequency shift of QCM was dependent on the immersion angle and that the theory with the immersion angle was quantitatively in good agreement with the experimental results. However, the effect of the immersion angle of the resonant frequency shift of QCM in an electrolytic solution is still not investigated. Therefore, in the present paper, we attempted to elucidate the effects of the immersion angle of the one-face sealed QCM in the electrolyte solutions. We used NaCl, $NaNO_3$, KCl as electrolytes. In the paper, we show that the resonant frequency shift of QCM is dependent on the immersion angle and discuss the relationship between a Newtonian liquid and an electrolytic solution on the basis of the present experimental result

Fig.1 Schematic illustration of an experimental apparatus

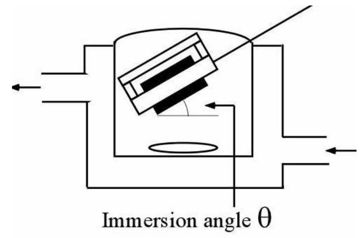

Fig.2 Schematic illustration of the angular mounting of the QCM in the experiments.

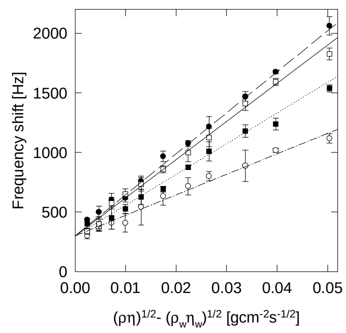

Fig.3 Resonant frequency shift on the one-face sealed QCM of 9MHz. The immersion angle of the QCM was varied in experiments: ○,0;■,30;□,60;●,90. The long dashed line, the solid line, the dotted line and dash-dotted line were calculated using Eq.(1)+300 with θ =0, 30 ,60, 90° respectively.

Reference
1.Kanazawa, K.K.; Gordon, J.G. *Anal. Chim. Acta* 1985, 175, 99
2.Yoshimoto, M.; Kurosawa, S. *Anal. Chem*. 2002, 74, 4306-4909.