The Investigation for the Behaviors of Surfactants Influenced Electroplating through Polymeric Mask

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It is known that surfactants can provide not only the solubility of hydrogen in electrolyte but also the acceleration of the release of hydrogen bubbles by decreasing the surface tension of the electrolyte [1,2]. However, The requirement of the surfactant selection on electroplating through mask is stricter than the traditional electroplating therefore results in difficulty occurring. Most of the works in the literature studied the deposition layer right after the electroplating process and the lack of the in-situ observation would make the post electroplating process analysis more difficult due to some of the parameters would mutually influenced. This paper studies the behaviour of several candidate surfactants on bubble forming process and the in-situ observation provides a powerful tool confirming significant evidence on the characteristics of the surfactants; through this in-situ observation, the suitable surfactants can be selected and therefore the big produced bubbles could be avoided in the future electroplating through mask system. (the detailed designed device please see the "A new method for the evaluation of electrodeposition behavior for electroplating through mask" which appears in this conference meeting abstract)

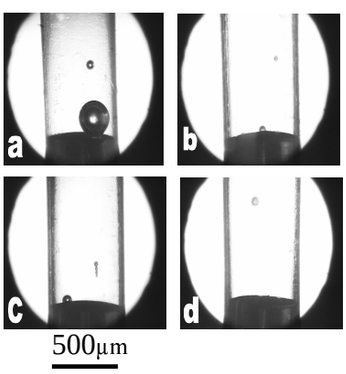

Figure 1. Showing that the produced bubble size can be very different by choosing the various surfactants (a) TX-100 (b) CTAB (c) SDS (d) FS under the aspect ratio 4, current density 10 condition (AR: 4, CD: 10ASD).

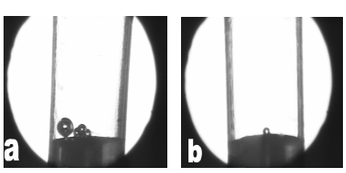

Figure 2. Showing that the produced bubble size can be influenced by choosing the different concentration of surfactant CTAB (AR: 4, CD: 10ASD) at the concentration (a) 200 ppm (B) 400 ppm.

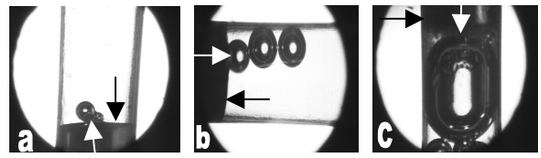

Figure 3. Showing the produced bubble sizes (white arrowed) of electroplating through mask system by carrying out the electroplating in (a) open upward, cathode (as black arrowed) face-up), (b) horizontal and (c), open downward (cathode face-down) at the AR: 4, CD: 10ASD, by employing surfactant CTAB at the concentration of 200ppm.

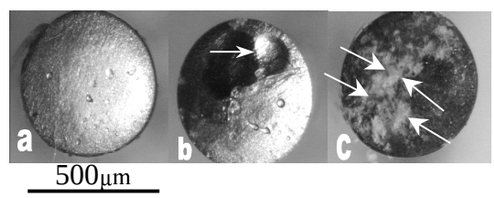

Figure 4. Showing that the corresponding deposition layer microstructure of (a) Fig.3a , a smooth surface due to the produced bubble did not remain in the deposition layer (b) Fig.3.b., big hole (as arrowed) present in the deposition layer, and (c), the $Ni(OH)_2$ is observed (as arrowed area) as the mass transfer becomes more difficult together with the PH increased in the double layer near the cathode surface. This would significantly decrease the deposition rate of Ni ion and result in the precipitation of $Ni(OH)_2$.

Reference

1. W. Prapaittrakul, Shwikhat,A, A.D.King Jr.,J. Colloid Interface Sci., **115**, 443,(1987).
2. K. Parker, AESF SUR/FIN, **Session B**, (1984).