자기조립단분자막을 이용한 구리 재배선 상의 Overburden 방지
Preventing Overburden on Cu Redistribution Layers with Self-Assembled Monolayers

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In recent years, the Fan-out Wafer Level Package (FoWLP) technology has being drawn attention due to reducing packaging cost and increasing I/O for high performance. Redistribution layers (RDL), one of the important parts for FoWLP process, are formed using seed deposition, patterning, and Cu electrodeposition to rearrange I/O connections on the die. During Cu electrodeposition for the RDL process, overburdens were formed on top surfaces patterned submicrometer trenches. The Chemical Mechanical Polishing (CMP) has been used to remove these overburdens in semiconductor industry, however, this CMP process caused an increase in process cost. The microcontact printing (μCP) process which transfers the self-assembled monolayers (SAMs) on the top surface of trenches can be one of the solutions suppressing the Cu deposition on these top surfaces to minimize the thickness of the Cu overburden. SAMs are organic molecules that formed spontaneously on solid surfaces by chemisorption and organization of alkanethiol, silane, and so forth. The monolayers, which are highly oriented and densely packed, provide effective blocking of electrochemical reactivity at coated substrate. Copper surfaces have highly activity in the chemisorption of alkanethiol molecules. Alkanethiol on the top Cu surface acts as an electrochemical barrier leading to selective electrodeposition of Cu films. In this research, flat PDMS stamp is used for providing on top surface patterned substrate. So, μCP is applied to selective electrodeposition.

In this study, μCP process was proceeded by forming nanometer thickness of the SAMs of alkanethiol on a flat polydimethylsiloxane (PDMS) stamp and transferring these SAMs using the SAMs-formed PDMS stamp on a patterned substrate. Cu electrodeposition under various sizes of trench pattern in Cu/H_2SO_4 electrolyte was proceeded. Electrochemical properties such as desorption behavior of SAMs depending on the carbon chain length were investigated. The SAMs on the top surfaces, surface morphology, and cross-sectional view of Cu filled trenches were observed. Consequently, SAMs on printed area inhibited Cu electrodeposition. This result reveals the feasibility of Cu trench-selective deposition in various dimensions. The μCP method shows the possibility of replacing CMP which removes overburdens of Cu for the RDL process.