INCREASE IN STRETCHABILITY OF THERMALLY GROWN SILICON DIOXIDE FILM

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Silicon dioxide film has become one of the candidates for encapsulation layer due to its low water permeability. Although stretchable organic devices have been widely studied, research related to stretchable encapsulation are insufficient. In this research, we studied nanomechanics to increase stretchability of silicon dioxide thin film. One way to increase stretchability is forming wrinkles on a film by using elastomer as a substrate. Before forming wrinkles, mechanical properties of the flat film should be analyzed as a stretchability of wrinkled film is determined by mechanical properties of the film and the substrate. High elastic deformation limit of the flat film makes highly stretchable wrinkled film. Therefore, we applied Griffith theory to increase elastic deformation limit of the film, which means we studied to decrease the size of the silicon dioxide film. For this reason, first, thickness of silicon dioxide was decreased to apply thickness effect that the size and distribution of defects decrease as thickness decreases. Second, thermal oxidation was used to grow silicon dioxide since this method fabricate silicon dioxide film having rare defects. To analyze the thickness-dependence on elastic deformation limit we evaluated mechanical properties of 50, 100, and 200 nm-thick freestanding thermally grown silicon dioxide film. Precise mechanical properties were evaluated by performing in-SEM tensile tests and push-to-pull devices were used to control thin specimen.