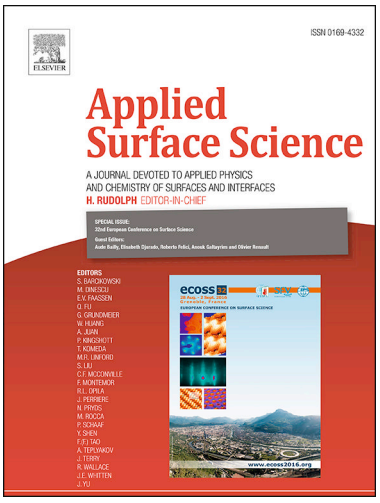

Full Length Article

Solid-state dewetting of Au–Ni bi-layer films mediated through individual layer thickness and stacking sequence

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Solid-state dewetting of Au–Ni bi-layer films mediated through individual layer thickness and stacking sequence

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In the present work, the solid-state dewetting of Au–Ni bi-layer thin films deposited on SiO_2/Si is systematically studied with respect to individual layer thickness and stacking sequence. For this purpose, a rapid heat treatment at medium temperatures is applied in order to examine void formation at the early stages of the dewetting. Compositional variations are realized by changing the thickness ratio of the bi-layer films, while the total thickness is maintained at 20 nm throughout the study. In the event of Au/Ni films annealed at 500 °C, crystal voids exposing the substrate are missing regardless of chemical composition. In reverse order, the number of voids per unit area in two-phase Au–Ni thin films is found to be governed by the amount of Au-rich material. At higher temperatures up to 650 °C, a decreased probability of nucleation comes at the expense of a major portion of cavities, resulting in the formation of bubbles in 15 nm Ni/5 nm Au bi-layers. Film buckling predominantly occurred at phase boundaries crossing the bubbles.

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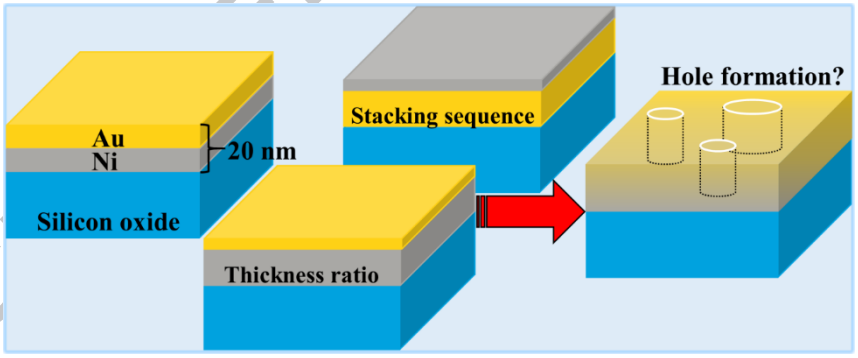
GRAPHICAL ABSTRACT



KEYWORDS

Au, Ni, bi-layer, solid state dewetting, crystal voids, phase boundary

HIGHLIGHTS

- Upon annealing at elevated temperature, bi-layer films are more susceptible to void formation in Ni on top of Au bi-layers than in Au on top of Ni bi-layers.
- Number of voids per unit area strongly correlates with thickness ratio variations.
- Void nucleation is retarded in buckled Au–Ni thin films.