

# **Nano-mechanical Behaviour and Microstructural Evolution of Cu/Si Thin Films at Different Annealing Temperatures**

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## **Abstract**

This study investigates the nano-mechanical properties of as-deposited Cu/Si thin films indented to a depth of 2000 nm using a nanoindentation technique. Cu films with a thickness of 1800 nm are deposited on (100) silicon substrates and the indented specimens are then annealed at temperatures of 160°C and 210°C, respectively, using rapid thermal annealing (RTA) technique. The results show that the hardness and Young's modulus of the Cu/Si thin films have maximum values of 0.82 GPa and 95 GPa, respectively. The TEM observations show that the specimens annealed at a temperature of 160°C, the amorphous nature of the microstructure within the indented zone is maintained. However, annealed at a higher temperature of 210°C, the indentation affected zone consists of Copper silicide ( $\eta$ -Cu<sub>3</sub>Si) precipitates are observed in the annealed specimens. Overall, the results presented in this study confirm that the annealing temperature has a significant effect on the formation of  $\eta$ -Cu<sub>3</sub>Si in nanoindented Cu/Si thin-film systems.

**Keywords:** Nanoindentation, Silicon, Microstructural evolution, Annealing temperature

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