VIDEO ARTICLE

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New Insight into Vertical Topographical Selective Deposition of Tantalum Oxide Ta_2O_5 by Morphological Analyses

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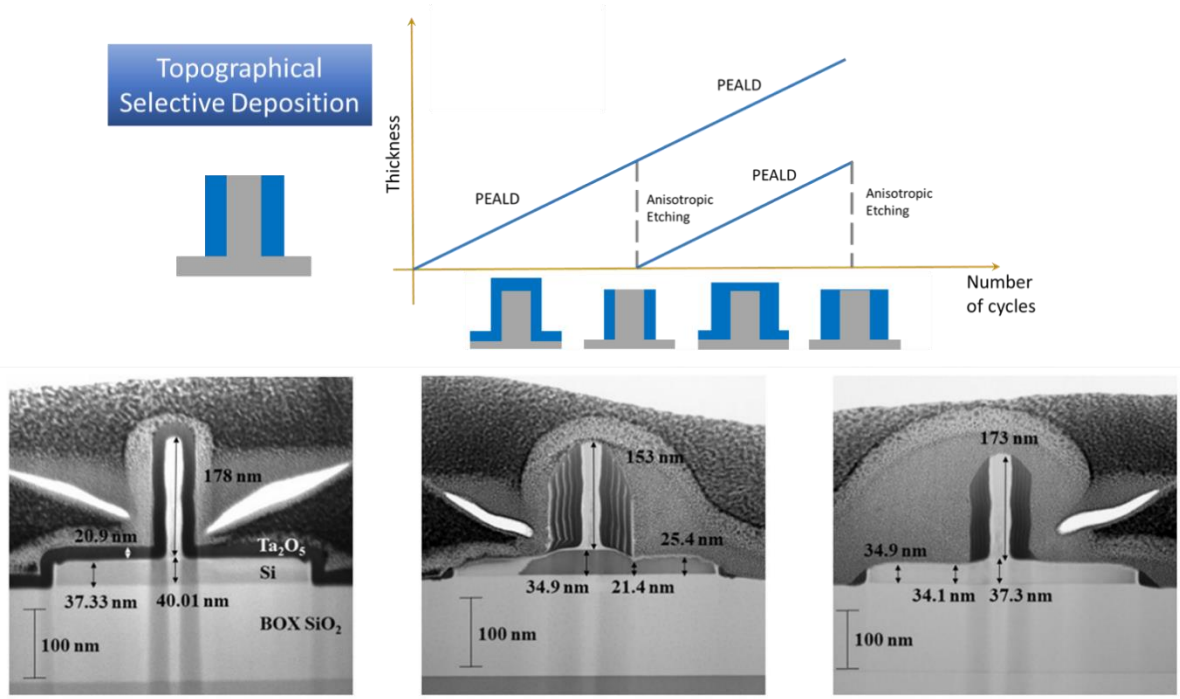
Graphical Abstract

Topographical Selective Deposition (TSD) for direct vertical coating of 3D features represents a key point in miniaturization of microelectronic devices, reducing cycle time, fabrication costs and process variability.



Abstract

In the race of electronic miniaturization, current top-down processes are reaching their limits and new bottom-up techniques are evolving rapidly [**1**]. Avoiding numerous and costly fabrication process steps and placement errors, Area Selective Deposition (ASD) is attracting a lot of attention, even though implementation, settings and shortcomings of this innovative technique remain challenging at the moment [**2**]. When dealing with 3D features, selective deposition is named Topographical Selective Deposition (TSD) and can lead to the fabrication of vertical-only coating of 3D substrates. This TSD is of particular interest for potential applications such as direct gap filling or spacer definition for instance.

In this work, we develop a Ta_2O_5 TSD process using super-cycles alternating Plasma-Enhanced Atomic Layer Deposition (PEALD) steps and two different approaches of anisotropic etching steps: quasi-Atomic Layer Etching (ALE) and argon ion sputtering [**3**]. Nanocharacterization of obtained results is presented and allows an accurate analysis of modifications in the Ta_2O_5 vertical film deposited with various ASD approaches. Results clearly show differences in terms of thickness, texture and chemical element composition. More specifically, one approach including quasi-ALE step shows better results with limited damages of the 3D features.

Therefore, morphological analysis of thin films helped to choose better selective deposition processes, as a pathway towards industrial applications of ASD.

Keywords: Nanocharacterization; topographical selective deposition; plasma-enhanced atomic layer deposition.

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