# Effects of deposition temperatures and alternating cyclic pulses of $W(N\text{-}t\text{-}Bu)_2(NmeEt)_2$ and ammonia on the properties of WN films

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## *ABSTRACT*

In microelectronic devices with deep sub micron features, it is essential to use conformal processes for the deposition of various metals, oxides, nitrides, and/or carbides. Atomic layer deposition (ALD) of metal nitrides has been intensively studied recently using both inorganic and metal-organic precursors for the applications of diffusion barrier in IC devices. In the literatures, there are only few reports reports on tungsten nitride (WN) ALD. Therefore, we investigated metal-organic ALD (MOALD) of WN using a precursor, $W(N\text{-}t\text{-}Bu)_2(NmeEt)_2$.

Tungsten nitride films were grown using cyclic pulses of $W(N\text{-}t\text{-}Bu)_2(NmeEt)_2$ and ammonia on silicon dioxide substrates at the deposition temperatures of 300 - 400 ℃. The effects of reactants pulse time and their purging period on the film growth rate were investigated. The growth rate increased with the substrate temperature. Successful WN growth was possible even at below 300 ℃ under the conditions investigated, but the resistivity of the films was extremely high. Regardless of the sample preparation conditions, the resistivity of the deposited films increased gradually after exposing the films to air due to the oxygen incorporation. Resisitivity of the as-deposited WN films was very sensitive to the deposition temperature. Increasing the deposition temperature provided lower film resistivity and higher film stability in air. The effects of process variables on the other properties such as crystallinity, barrier effectiveness, and conformality of the WN films will be presented.