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# HOT-WIRE CHEMICAL VAPOUR DEPOSITION AND CHARACTERIZATION OF SILICON NITRIDE THIN FILMS

L.M. Goncalves [1,*], P. Alpuim[2], S. Filonovich [2], T.M.R. Viseu[3], S. Lanceros-Mendez[3]

1 University of Minho, Industrial Electronics Department, 4800-058 Guimarães, Portugal
2 University of Minho, Physics Department, 4800-058 Guimarães, Portugal
3 University of Minho, Physics Department, 4710-553 Braga, Portugal
* corresponding author: lgoncalves@dei.uminho.pt

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## Abstract

Silicon Nitride was deposited by hot-wire chemical vapor deposition (HW-CVD) as a high-deposition-rate, low-temperature alternative technology to the conventional high-temperature thermal or CVD growth methods. Moreover, deposition at very low (<200ºC) substrate temperature allows the use of flexible plastic substrates. Using a gaseous mixture of silane ($SiH_4$) and ammonia ($NH_3$), thin films were deposited at $NH_3/SiH_4$ flow rate ratios between 1 and 70 and substrate temperatures of 250ºC and 100ºC. The structural properties of the films were studied by Fourier transform infrared (FTIR) spectroscopy and ultraviolet-visible spectroscopy. Using flow rate ratios between 40 and 70, compact films with good optical and dielectric properties were obtained. Refraction index was calculated from optical transmission data, and values between 1.93 and 2.1 were observed. Perpendicular current transport (I–V measurements) through the films was measured between patterned aluminum contacts on metal–insulator–metal capacitor structures with an area ~ $10^{-2}$ $mm^2$, showing breakdown fields > 1 MV $cm^{-1}$. Etch rates below 3 nm/min in buffered hydrofluoric acid was obtained.
Using the appropriate deposition parameters, it was possible to prepare, at 100 °C, silicon nitride dielectric films on flexible plastic substrates with electronic properties compatible with use as gate dielectrics of thin-film transistors or passivation layers in electronic devices.
Dielectric quality of the silicon nitride films will be further studied using high-frequency and quasi-static *C-V* measurements and metal-dielectric interface defect density will be accessed.
Electrical conduction mechanisms in the dielectric films will be studied as a function of the measuring temperature in films deposited at 250ºC and 100ºC substrate temperatures.