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PII: S0925-8388(17)33402-3
DOI: 10.1016/j.jallcom.2017.09.340
Reference: JALCOM 43396

To appear in: *Journal of Alloys and Compounds*

Received Date: 19 July 2017
Revised Date: 29 September 2017
Accepted Date: 30 September 2017

Please cite this article as: S. Guha, S. Das, A. Bandyopadhyay, S. Das, B.P. Swain, Investigation of structural network and mechanical properties of Titanium silicon nitride (TiSiN) thin films, *Journal of Alloys and Compounds* (2017), doi: 10.1016/j.jallcom.2017.09.340.

Investigation of Structural network and Mechanical Properties of Titanium Silicon Nitride (TiSiN) Thin Films

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Abstract:

Titanium silicon nitride (TiSiN) thin films were deposited on p-type c-Si (100) with different N_2 flow rate by using chemical vapor deposition (CVD) technique. The microstructure, phonon modes, mechanical properties and compositional studyof TiSiN thin films were characterised by scanning electron microscope (SEM), X-ray diffraction (XRD), Raman spectroscopy, nanoindentation and X-ray photoelectron spectroscopy (XPS),respectively. The SEM images show increases insurface roughness with increasing of N_2 flow rate, however, improvesthe hardness and Young's modulus of TiSiN thin film. The XRD analysis reveals the presence of strain in TiSiN films. The estimated crystallites of TiSiN thin films was 7.51 and 7.39 nm for 40 and 100 sccm N_2 flow rate. The XPS reveals the presence of 20 at. % Si content at 40 sccm N_2 flow rate in the TiSiNfilm. To analyse the broad Raman spectra of TiSiN thin films, the peaks were convoluted into six individual Gaussian peaks. The quantitative and qualitative analysis XPS and Raman spectra of TiSiN thin films were carried out by using Origin 9.0 software.

Keywords: Thermal CVD, Mechanical properties, SEM, XRD, Raman, Nanoindentation.