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Optical Properties of SiN:H thin films obtained by hydrogen dilution

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Abstract :

Hydrogenated silicon nitride (SiN:H) is a versatile material with applications in many industries. Recently much focus has been placed on the manufacturing of SiN as an antireflective coating on top of microcrystalline silicon (mc-Si) solar cells [1]. The preferred deposition method of Plasma Enhanced Chemical Vapour Deposition (PECVD) delivers low film growth rates. The material exhibit porous characteristics as a result of constant ion bombardment [1]. In this study SiN was deposited by diluting silane and ammonia with hydrogen in a Hot Wire Chemical Vapour Deposition (HWCVD) chamber. HWCVD offers high growth rates with stable, dense films exhibiting excellent optical properties [2], in comparison to PECVD.The thin films were deposited on Corning 7059 glass and crystalline silicon <100> substrates. UV-VIS spectra were obtained in reflection mode on the glass substrate, and the optical modelling was performed using a Bruggerman Effective Medium Approximation (EMA). Optical fits for the spectra were obtained using TFCompanion® and Scout® software. The mean square error function values for single layer homogenous materials on substrates indicate inaccurate fits and subsequent extracted optical properties of the material. Hence a virtual multi-layered approximation for a single film was adopted to describe a material that possesses dissimilar optical properties in its bulk compared to interface regions [3]. In the EMA matrix Cauchy [4] /OJL [5] materials were mixed with particles required to describe SiN, and the results obtained for the different fits are contrasted in terms of their optical constants. References:[1] B. Stannowski, J.K. Rath, R.E.I. Schropp, J. Appl. Phys. 93, (2003) 2618.[2] B. Stannowski, C.H.M. van der Werf, R.E.I. Schropp, Proc. Of the 3rd Intern. Conf. on Coatings on Glass, Oct 29- Nov 2 2000, Maastricht, pp. 387-394.[3] S.P. Singh, G.V. Prakash, S. Ghosh, S. Rai, P. Srivastava, EPL 90 (2010) 26002.[4] T. Mocking, Studies of Nanostructured Layers with UV-VIS Spectroscopic Ellipsometry, Linköping University, Sweden, 2008.[5] S.K. O'Leary, S.R. Johnson, P.K. Lim, J. Appl. Phys. 82 (1997) 3334.

Award :

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