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

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Abstract content
   (Max 300 words)

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.

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