OR2006

Influence of radiofrequency magnetron sputtering and microwave plasma combination on the elaboration of SiCxNy:Hz thin films

Abdellatif BACHAR[1], Angélique Bousquet[1], Christine Robert-Goumet[1], Guillaume Monier[1], Thierry Sauvage[2], Laurent Thomas[3], Eric Tomasella[1]

[1]Clermont Auvergne University, Aubière, France [2]CNRS CEMHTI, Orléans, France [3] CNRS PROMES, Perpignan, France

abdellatif.bachar@uca.fr

In the present work, hydrogenated silicon carbonitride (SiC_xN_y:H) thin films were elaborated by the mean of a hybrid process combining RF sputtering and ECR plasma, in the goal to use them as antireflective coatings and hence to increase the efficiency of PV cells. This material was obtained by sputtering a Si target under an Ar-N_2-CH_4 gas mixture, and four coaxial microwave sources while the reactive gas flow ratio R = $[F_{N2}]$/ ($[F_{N2}]$ + $[F_{CH4}]$) was varied. The study is conducted in order to verify the tunability of the chemical composition of SiC_xN_y:H versus R, which leads to control their refractive indices. That make them an attractive antireflective coatings for silicon PVs. The plasma was studied using OES to identify the different emitting species related to the sputtered silicon and the reactive gas decomposition efficiency. According to the performed RBS analysis, we could tune the carbon and nitrogen rates in a wide range (going from a silicon carbide like film for R=0 to a silicon nitride like film for R=1). XPS analyses were performed to identify the chemical environment of the elements forming the films and the evolution of the main bond components was studied showing a decrease of Si-C and increase of Si-N with R. FTIR was used to define bonded hydrogen contents in the films, its amount decreases with R and a preferential Si-H bonds formation instead of C-H (produced by CH_4 decomposition) was highlighted. Total hydrogen amount of the films was also determined by the mean of ERDA analysis. Refractive indexes of the deposited films were characterized using spectroscopic ellipsometry, a relatively large scale [1.8- 2.3] at 633 nm of n values was obtained versus R, the same behavior was observed for optical band gap values measured by UV-visible spectroscopy [2- 4.5 eV].

Keywords
Reactive spuettering
SiCxNy:H
Optical properties
XPS-RBS