A hybrid deposition process combining reactive magnetron sputtering and microwave plasma for the elaboration of a-SiCxNy:H

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A new thin film deposition process is studied for the elaboration of hydrogenated silicon carbonitrideSiCxNy:H. In previous studies [1],physical vapor deposition (PVD) and plasma enhanced chemical vapor deposition (PECVD) were used to elaborate SiCxNy:H,thin films as an antireflective and passivation coatingfor photovoltaic devices. Our particular work aims to combine both reactive magnetron sputtering using a silicon target (purity 99.99%) under Ar-N2-CH4 gas mixture, and four (2.45 GHz) coaxial microwave sources.The challenge behind this combination is to increase the deposition rate and to have more homogeneous coatings. Different compositions ofSiCxNy:H have been deposited at 450 °C by varying reactive gas flows ratio Rf = $[F_{N2}]$/ ($[F_{N2}]$ + $[F_{CH4}]$). The different film compositionswere studied by XPS and RBS. FTIR allowed us to measure the amount of bonded hydrogen.The optical properties were characterized by spectroscopic ellipsometry. Preliminary results show that the new process allows us obtaininga wide range of SiCxNy:H compositions versus the gas flows ratio. Films are transparent in all the studied wavelength range [400-1000 nm]. Good variation ofrefractive index was obtained, ranging from 2.3 for a carbide like coating to 1.8 for a nitride like one.

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