Sol-Gel Synthesis of thin films SiO2/TiO2 antireflection coating on silicon for photovoltaic application

S.kermadi [1], N.Agoudjil [2], M.Boumaour [1]

1-Unite de Developpement de la technologie du silicium. Bd. Frantz Fanon.BP.399 Alger
2-Faculte de chimie USTHB BP 32 EL ALIA Bab Ezzouar Alger.

Abstract

The most important application of silicon in the visible region is photovoltaic solar cells. The high reflectivity of silicon causes a great loss of incident light on its surface across most of the solar spectrum .To increase the solar energy conversion ,this loss can be appreciably reduced by coating the silicon with thin ,transparent ,dielectric layer with an appropriate dielectric constants and thickness.
TiO2 was selected because it is a common use ,has a high refractive index , high transparency to the visible and an excellent chemical resistance.
Application of thin films of SiO2 and TiO2 using the sol-gel process were utilized as antireflection coating on monocrystalline silicon wafers.The aim of this study is validate this process as a procedure to prepare antireflective films for monocrystalline silicon by dipcoating.The coating was carried out by dipcoating process using tetraethoxysilane as precursor for SiO2 and titanium isopropoxyde as precursor for TiO2. In order to study the influence of the thickness on the reflectance and the optical parameters ,several coatings with different thickness were deposited onto silicon wafers.
Optical characteristics of TiO2 thin films prepared by sol-gel technique have been studied.The deposition parameters are optimized to yield uniform and well adhering films. The film thickness can be easily controlled by increasing the number of dipping.
The optical constants (refractive index , and extinction coefficient ,k) were accurately determined. A slight growth of refractive index is observed with the film thickness.The extinction coefficient keeps constant and approaches to zero for all samples .
Good correlation obtained between the optical thickness determined using reflectance spectra and ellipsometric measurements.
The solar-averaged reflectance of the TiO2 single layer and SiO2/TiO2 double layer was determined.
The above results show that it is possible to fabricate sol-gel TiO2/SiO2 layers with the required optical qualities and thickness for photovoltaic applications.

Key words : Sol-Gel , optical properties ,antireflection coating