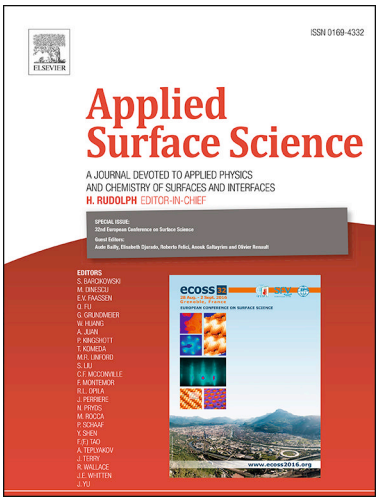

Full Length Article

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Tsung-Cheng Chen, Tsuo-Chuan Yang, Hsyi-En Cheng, Ing-Song Yu, Zu-Po Yang

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Single Material TiO_2 Thin Film by Atomic Layer Deposition for Antireflection and Surface Passivation Applications on P-Type C-Si

Tsung-Cheng Chen [a+], Tsuo-Chuan Yang [a+], Hsyi-En Cheng [b], Ing-Song Yu [c], Zu-Po Yang [a]

[a] *Institute of Photonic System, National Chiao Tung University, Tainan 71150, Taiwan*
[b] *Department of Electro-Optical Engineering, Southern Taiwan University of Science and Technology, Tainan, 710, Taiwan*
[c] *Department of Materials Science and Engineering, National Dong Hwa University, Hualien 97401, Taiwan*
[+] *Equal contribution*

To whom to correspond:

zupoyang@nctu.edu.tw; Fax: 886-6-3032535; Tel: 886-6-3032121-57762

bobchen.cop05g@nctu.edu.tw; Fax: 886-6-3032535; Tel: 886-929-903-388

Abstract

A thin film deposited on the front surface of solar cell plays an important role in reducing the reflection of incident light and providing surface passivation. Although ultrathin TiO_2 films have shown excellent performance of surface passivation, simultaneously serving both functions is hindered by the crystallization issue, which can degrade the passivation quality of TiO_2 film, as the film thickness is over certain value (few nanometer only). Here we showed that both functions can be satisfied by single material of titanium oxide film through atomic layer deposition at low temperatures. By varying deposition temperatures from 80 to 200 ^oC, the TiO_2 film deposited at 80 ^oC can maintain its amorphous phase up to the thickness of 114 nm. In addition, the optimal thickness for antireflection calculated by OPAL 2 is 61 nm, meaning that amorphous TiO_2 film to provide antireflection and surface passivation can be achieved. The passivation quality is verified by minority carrier lifetime measurement using photo-conductance decay method and presented the ultralow surface recombination velocity of 8.7 cm/s. Furthermore, the passivation mechanism