Sputter-deposited oxides for interface passivation of cdte photovoltaics

Together these results suggest that selenium alloying creates a passivation effect in CdTe that explains the higher open-circuit voltage and improved performance of selenium ...

Subsequent absorber deposition and passivation treatment were carried out in an automated, in-line CSS deposition system [42]. ... Sputter-deposited oxides for interface passivation of CdTe photovoltaics. IEEE J. Photovolt. (2018) ... When employed as a buffer layer in CdTe solar cells, CMT can reflect electrons due to its good lattice matching ...

The goal of this project was to study the use of sputter-deposited oxide materials for interface passivation of CdTe-based photovoltaics. Several candidate materials were ...

Cadmium telluride (CdTe) photovoltaics is a promising and scalable technology, commanding over 90% of the thin film photovoltaics market. An appropriate window layer is crucial for high-efficiency CdTe solar cells. ...

Adding a thin layer of Al2O3 to the back of CdSeTe/CdTe devices has previously been shown to passivate the back interface and drastically improve surface recombination lifetimes. Using such a structure, lifetimes of over 400 ns have been recorded. Despite this, such devices do not currently show an improvement in open-circuit voltage (VOC) that is ...

Kephart et al. studied the application of sputter-deposited oxides for interface passivation in CdTe photovoltaics and found that Al 2 O 3 shows the strongest passivation effect at the front interface and the highest lifetime and ...

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Oxide passivation layers made by sputter deposition have the potential to increase voltage by reducing interface recombination. CdTe devices with these passivation layers were ...

Semantic Scholar extracted view of "Band alignment of front contact layers for high-efficiency CdTe solar cells" by J. Kephart et al. ... Sputter-Deposited Oxides for Interface Passivation of CdTe Photovoltaics. J. Kephart Anna Kindvall +4 authors W. Sampath. ... Stable magnesium zinc oxide by reactive Co-Sputtering for CdTe-based solar cells.

The realization of a transparent back buffer layer would be a significant boon for the CdTe community. Simulations presented here reveal a substantial performance increase in ultrathin cells through incorporation of a back buffer, as well as high bifaciality if transparent contacts are assumed. This project aims to deposit a p-type transparent conducting oxide ...

This defect passivation explains the remarkable performance of CdSeTe devices. However, current high-efficiency devices only have selenium in significant concentrations at the very front of the device, leaving much of the back of the absorber layer unpassivated.

This value is high among CdTe photovoltaics research laboratories, and devices made using this exact deposition system and method have achieved certified conversion efficiencies of up to 18.3% 16 (only exceeded by the 22.1% champion cell fabricated by First Solar 2).

Back-Surface Passivation of CdTe Solar Cells Using Solution-Processed Oxidized Aluminum. ACS Applied Materials & Interfaces 2020, 12 (46) ... W. Sputter-deposited oxides for interface passivation of CdTe photovoltaics. Journal of Photovoltaics 2018, 8 (2), 587 - 593, DOI: 10.1109/JPHOTOV.2017.2787021.

KEYWORDS: interface passivation, CdTe, back contact, solution processed, alumina INTRODUCTION Recent improvements in the materials and interfaces in CdTe thin-film solar cells have led to increases in the photo-conversion efficiency (PCE), with the record now at 22.1%.1 While the short circuit current density (J sc) is near bandgap-

These results show that in non-alloyed CdTe there are deep-level defects in the bulk material that act as recombination centres and limit device efficiency, even following the CdCl 2 treatment.

This work reports a study of the passivation effects of different dielectric thin films deposited on monocrystalline CdTe/MgCdTe double heterostructures (DHs) using atomic layer deposition (ALD). Enhanced photoluminescence intensity was observed in all DHs with surface passivation, and increased photogenerated carrier lifetime was observed in DHs with HfO2, ...

A sputtered CdMgTe electron reflector layer permitted low fabrication temperatures and circumvented the intolerance of CdMgTe to thermal processing present in traditional close ...

Time-resolved photoluminescence measurements at the back surface and quantum efficiency measurements performed at the maximum power point indicate that the performance enhancement is due to a reduction in the interface recombination current at the backs of CdTe devices. Although back-surface passivation plays an important role in high-efficiency ...

Further efficiency gains require improved passivation of the bulk absorber material, grain boundaries, and interfaces. A highly resistive MgxZn1-xO (x = 0.23) window layer has ...

Magnesium zinc oxide (MZO) is a promising front contact material for CdTe solar cells.Due to its higher band gap than traditional CdS, MZO can reduce parasitic absorption to significantly increase short-circuit current density while also providing a benefit of conduction band offset tuning through Mg:Zn ratio optimization. MZO has been successfully implemented into ...

Fig. 2. TRPL data for the front interface passivation layers tested in device structures. (a) SiO2 shows a slight improvement in TRPL decay lifetime, while others cause a decrease. (b) Al2O3 was the most effective passivation material tested. - "Sputter-Deposited Oxides for Interface Passivation of CdTe Photovoltaics"

Together these results suggest that selenium alloying creates a passivation effect in CdTe that explains the higher open-circuit voltage and improved performance of selenium-graded CdTe solar cells. The CL image shown in Fig. 1 is of the panchromatic CL signal.

Magnesium zinc oxide (MZO, Mg x Zn 1-x O) is a leading emitter for CdTe-based solar cells due to its transparency and the ability to tune its conduction band offset with the absorber. Devices employing alloyed cadmium selenide telluride (CST, CdSe y Te 1-y) absorbers achieved high efficiency (>19%) using MZO deposited by reactive sputtering over a broad ...

The luminescence data presented here show that higher levels of selenium in the CdTe material lead to an increased CL signal intensity. This suggests that selenium passivates a defect in bulk CdTe, decreasing non-radiative recombination and increasing cell performance.

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A major source of loss in cadmium sulfide/cadmium telluride (CdS/CdTe) solar cells results from light absorbed in the CdS window layer, which is not converted to electrical current. This film can be made more transparent by oxygen incorporation during sputter deposition at ambient temperature. Prior to this work, this material has not produced high-efficiency devices ...

This paper investigates the suitability of CdTe photovoltaic cells to be used as power sources for wireless sensors located in buildings. We fabricate and test a CdTe photovoltaic cell with a ...

Sputter-deposited oxides for interface passivation of CdTe photovoltaics IEEE J. Photovoltanics, 8 (2) (2018), pp. 587 - 593, 10.1109/jphotov.2017.2787021 View in Scopus Google Scholar

In this study, carrier lifetimes in CdTe thin films coated with three kinds of metal oxides were measured by TRPL. In the CdTe thin films coated with a 3-nm-thick V 2 O 5 or Al 2 O 3 layer, the TRPL lifetime was increased compared to that of the bare CdTe or NiO-coated CdTe thin films. The minority carrier lifetime increase is attributed to the electric field effect ...

TRPL data for the front interface passivation layers tested in device structures. (a) SiO_2 shows a slight improvement in TRPL decay lifetime, while others cause a decrease. (b) Al_2O_3 was the ...

Here, we present a solution-fi based process, which achieves passivation and improved electrical performance when very small amounts of oxidized Al^{3+} species are deposited at the back ...

Here, based on the magnetron sputtering process, chemical passivation and electric field passivation can be achieved when a small amount of CdSe is deposited on the CdTe back surface. When the CdSe thickness is ~20 nm (Before annealing), the optimal cell current was increased from 23.8 mA/cm^2 to 26 mA/cm^2 and the efficiency was increased ...

Sputter-deposited oxides for interface passivation of CdTe photovoltaics," IEEE J. Photovoltaics. 8 (2), 587 ... "Transparent buffer layer for back surface passivation in CdTe photovoltaics," in . 2021 IEEE 48th Photovoltaic Specialists Conference (PVSC) (IEEE, 2021), pp.

A ~3.5 µm layer of CdTe was then deposited on top of the CdSeTe with the substrates held at 500 °C and the CdTe source at 555 °C. The CdTe and CdSeTe materials were provided by 5N Plus. A $CdCl_2$ activation treatment was then performed on one of the substrates.

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