JNPV 2015 abstract

Intended for **Topic 6** (Caractérisation avancée)
Title: Passivation optimisation by in-situ photoluminescence
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Introductive Summary

Surface passivation of solar cells by Al_2O_3 has proved its potential during the last decade [1]. However this material demonstrated its best performance when deposited by ALD which has a low deposition rate [2] compared to other PECVD industrial tools. When deposited by ALD, the fixed charges presented within Al_2O_3 layer seem to be thickness independent, while it is necessary to have at least 5 nm of Al_2O_3 in order to have a good chemical passivation. For this reason, industrials tend to use a thin film of Al_2O_3 (judged optimal) capped by a thicker film of *a*-SiN_x:H deposited by PECVD. Such stack aim is to satisfy the required industrial throughput of photovoltaic industry [3]. Because the capping layer contains also hydrogen, it could be interesting to understand the interaction between these two layers in order to be able to reduce Al_2O_3 thickness and maintain the passivation quality of the stack.

Purpose of the work

In a previous work, we found an optimum thickness of 6 nm for the Al_2O_3 passivation layer [4]. Recent work in our laboratory demonstrated the possibility of in-situ photoluminescence control of passivation quality during thermal treatment and PECVD process [5]. In the present work we investigate the surface passivation behaviour of Al_2O_3/*a*-SiN_X:H stacks on c-Si during electroplating thermal treatment (without applying any metal). The aim is to find the optimal thermal treatment to enhance passivation of electroplated cells. To do it, we have to understand the influence and equivalence of simple or cumulated thermal treatment on the passivation behaviour.

[1] Dingemans, G. and W. M. M. Kessels (2012). "Status and prospects of Al_2O_3-based surface passivation schemes for silicon solar cells." Journal of Vacuum Science & Technology A **30**(4).
[2] Black, L. E., et al. (2013). "Safe and inexpensive Al_2O_3 deposited by APCVD with single-source precursor". Proceedings of the 28th European Photovoltaic Solar Energy Conference, Paris, France.
[3] Kuznetsov, V. I., et al. (2014). "Al_2O_3 surface passivation of silicon solar cells by low cost ald technology". Photovoltaic Specialist Conference (PVSC), 2014 IEEE 40th.
[4] Abolmasov, S. N. and P. Roca i Cabarrocas (2015). "In situ photoluminescence system for studying surface passivation in silicon heterojunction solar cells." Journal of Vacuum Science Technology A **33**(2).
[5] Zauner, A., et al. (2014). "PERC solar cells comparison of Al precursors for rear-side surface passivation". Proceedings of the 29th European Photovoltaic Solar Energy Conference, Amsterdam, Netherlands.