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Preferred presentation type: Poster

Title: Light induced enhancement of AlO_X passivated silicon: Key parameters

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Instructions: Not size limited

Abstract:

In contrast with the passivation provided by hydrogenated amorphous silicon, which tends to degrade under UV irradiation[1], passivation by AlO_X leads to the opposite behavior namely beneficial ageing[2,3] (light induced enhancement of passivation), which has been previously reported for thick (30 nm) AlO_X layers. This study aims to find key parameters to take advantage of this effect with thinner AlO_X layers. Hydrogen is suspected to play a key role in this phenomenon, so its content has been varied to test this hypothesis. AlO_X thickness has been fixed at 6 nm, which is not thick enough to provide all the required hydrogen for chemical passivation. A PECVD a-SiN_X:H capping layer has been used as antireflective coating, moisture protection and a source of missing hydrogen for AlO_X/c-Si interface. To control hydrogen diffusion from the capping layer to the AlO_X/c-Si interface, an a-SiO_X layer deposited by PECVD was inserted between the AlO_X and the a-SiN_X capping in some samples. Hydrogen content and diffusion have been measured by ERDA and TDS, highlighting the efficiency of a-SiO_X as a barrier to hydrogen diffusion. Beneficial ageing has been evaluated by recording the effective lifetime of minority carrier by QSS-PC along illumination of sample. Depending on the permeability of the a-SiOx layer to hydrogen, a lifetime enhancement up to 125% is reported for sample having the most hydrogenated interface, even if it presents blistering. By reducing the interface hydrogenation, beneficial ageing is strongly decreased. Therefore, hydrogenation of the c-Si/AlO_X interface is essential for strong beneficial ageing.

[1]F. Lebreton, S. N. Abolmasov, F. Silva, and P. Roca i Cabarrocas. In situ photoluminescence study of plasma-induced damage at the a-Si:H/c-Si interface. *Applied Physics Letters*, 2016, vol. 108, no 5, p. 051603.

[2]G. Dingemans, P. Engelhart, R. Seguin, F. Einsele, B. Hoex, M. C. M. van de Sanden, and W. M. M. Kessels. Stability of AlOX and AlO_X/a-SiN x: H stacks for surface passivation of crystalline silicon. *Journal of Applied Physics*, 2009, vol. 106, p. 114907.

[3]B. Liao, R. Stangl, T. Mueller, F. Lin, C. S. Bhatia, and B. Hoex. Deposition temperature independent excellent passivation of highly boron doped silicon emitters by thermal atomic layer deposited AlO_X. *Journal of Applied Physics*, 2013, vol. 114, no 9