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Rear Surface Passivation of Silicon Solar Cell with AlON Layer by Reactive Magnetron Sputtering

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The surface recombination velocity of the silicon solar cell could be reduced by passivation with insulating layers such as SiO_2, SiNx, Al_2O_3, a-Si. Especially, the aluminium oxide has advantages over other materials at rear surface, because negative fixed charge via Al vacancy has an additional back surface field effect (BSF). It can increase the lifetime of the hole carrier in p-type silicon.

The aluminium oxide thin film layer is usually deposited by atomic layer deposition (ALD) technique, which is expensive and has low deposition rate. In this study, ICP-assisted reactive magnetron sputtering technique was adopted to overcome drawbacks of ALD technique. In addition, it has been known that by annealing aluminium oxide layer in nitrogen atmosphere, the negative fixed charge effect could be further improved. By using ICP-assisted reactive magnetron sputtering technique, oxygen to nitrogen ratio could be precisely controlled.

Fabricated aluminium oxy-nitride (AlON) layer on silicon wafers were analyzed by x-ray photoelectron spectroscopy (XPS) to investigate the atomic concentration ratio and chemical states. The electrical properties of Al/(Al_2O_3 or SiO_2,/Al_2O_3)/Si (MIS) devices were characterized by the C-V measurement technique using HP 4284A. The detailed characteristics of the AlON passivation layer will be shown and discussed.

Keywords: Solar cell, Passivation, BSF, Al2O3, AlON, Reactive magnetron sputtering