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Low temperature formation of emitter and BSF by rapid thermal co-diffusion of P, Al or B

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Rapid thermal processing (RTP) is now emerging as a promising simplified process for manufacturing of terrestrial solar cells in a continuous way. In earlier works, we have shown that RTP can advantageously replace the classical furnace for performing emitter, BSF and surface passivation in addition to an efficient gettering of metallic impurities during these steps. In this work, we present results about co-diffusion of two dopant elements in a single rapid thermal cycle at low temperature in order to form emitter and BSF simultaneously. We have, in particular, found that the diffusion kinetics of dopant elements are enhanced during rapid thermal co-diffusion of P, Al or B and lead to the optimal dopant activity and profile for high efficiency silicon solar cells at low temperature. Additionally, the gettering effect induced by the co-diffusion of P and Al is more efficient than can be achieved by a single diffusion of these two elements. Finally, test solar cells were performed on these structures and gave, for a low processing temperature (800/spl deg/C/60 s), an efficiency of 11% on polished FZ monocrystalline substrates without antireflecting coating.

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