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## Article

### Formation of shallow front emitters for solar cells by rapid thermal processing



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#### ABSTRACT

In this work we report on formation of shallow front emitters by phosphorus in-diffusion during rapid thermal processing (RTP). Both Filmtronics P509 diffusant and concentrated phosphoric acid were deposited on 1  $\Omega\text{cm}$  p-type mono crystalline silicon samples. Diffused shallow emitters were realized by annealing at 900 °C and 950 °C in the range of 10 – 40 s using an Annealsys AS-Micro furnace. The chemical concentration versus depth profiles of phosphorus were measured by secondary ion mass spectrometry (SIMS) and the sheet resistance was measured by four-point probing. It is found that emitters with depths in the range 100 – 275 nm and the maximum doping concentrations in the range  $2 \times 10^{20} - 1 \times 10^{21} \text{ cm}^{-3}$  can be formed after RTP. By varying the RTP-conditions, a sheet resistance of 314 – 40  $\Omega/\text{sq}$  for diffusant-treated samples and of 175 – 40  $\Omega/\text{sq}$  for phosphoric acid treated samples are obtained. The P509 diffusant and concentrated phosphoric acid gave similar emitter profiles. High solubility of phosphorus in silicon at elevated temperatures ensured a low sheet resistance even for short annealing times. It is shown that phosphorus in-diffusion during RTP is a viable method in formation of shallow front emitters for solar cells. In particular, the highest phosphorus peak concentration and the shallowest diffusion profile were achieved by in-diffusion from dehydrated phosphoric acid (© 2012 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim)

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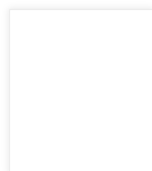
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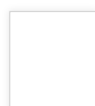
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