SS7

A Statistical Approach for the Optimization of Photovoltaics: Experiments & Simulations

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Abstract In general, the performances of the c-Si-based solar cell strongly depend on the each layer properties, such as antireflection coating, emitter, back-surface field etc. In addition, the interrelation between process parameters is complicated; some properties in each layer components have opposite influences on the device's characteristics, such as emitter, which is thinner for better J_{sc}, but yet, this thinner layer could cause detrimental effects on the FF owing to lower sheet-resistance. Therefore, a useful method to both define the optimum condition and significantly reduce the experiment time is necessary for an effective fabricating process. In this talk, the Taguchi method via an orthogonal array employed to design both the experiments and the simulations will be presented. The optimal condition for high performance of the c-Si-based solar cells was computed via dominant level of factor through signal-to-noise ratios. Moreover, with the help of the analysis variance, the percentage contribution of the layer on the solar cell performance was also discussed in details. Finally, the Grey relational analysis had been performed to carry out the optimal combination of condition for multiple characteristics. Based on our approach, the number of experiments and/or simulations is reduced by approximately >90%; while the reproduction effect of process parameters on the performance characteristics is still ensured.

Keyword(s)
Taguchi method, Analysis of variance, Grey relational analysis, c-Si-based solar cells, Simulation

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