

**INCREASING
YIELD WITH
POST-FIRING
ANNEAL**

A proven way to improve the efficiency of under-performing screen-printed cells is to introduce a post-firing forming gas anneal. This anneal improves several cell aspects and thus increases the efficiency. The mechanisms behind this improvement are:

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- ◆ Forming gas annealing (FGA) – helps reduce silver paste glass layer, lowering series resistance

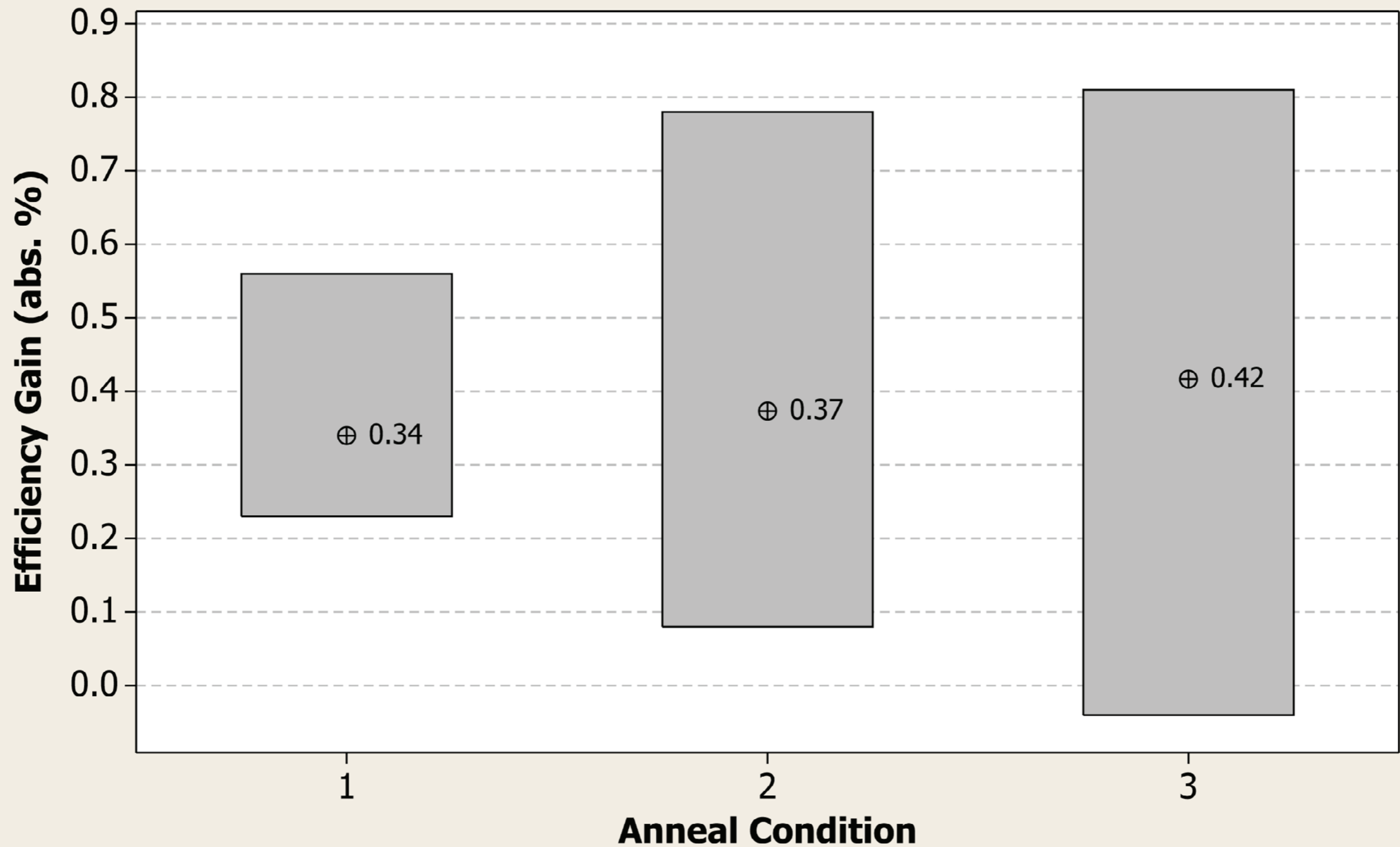
HYDROGEN PASSIVATION

- ◆ Hydrogen passivates defects present in the silicon surface and bulk
- ◆ For advanced cell designs, thermal annealing can help enhance passivation layers such as SiO_2 , Al_2O_3 , or doped back surface field, which can significantly boost open-circuit voltage

DEFECT REPAIR

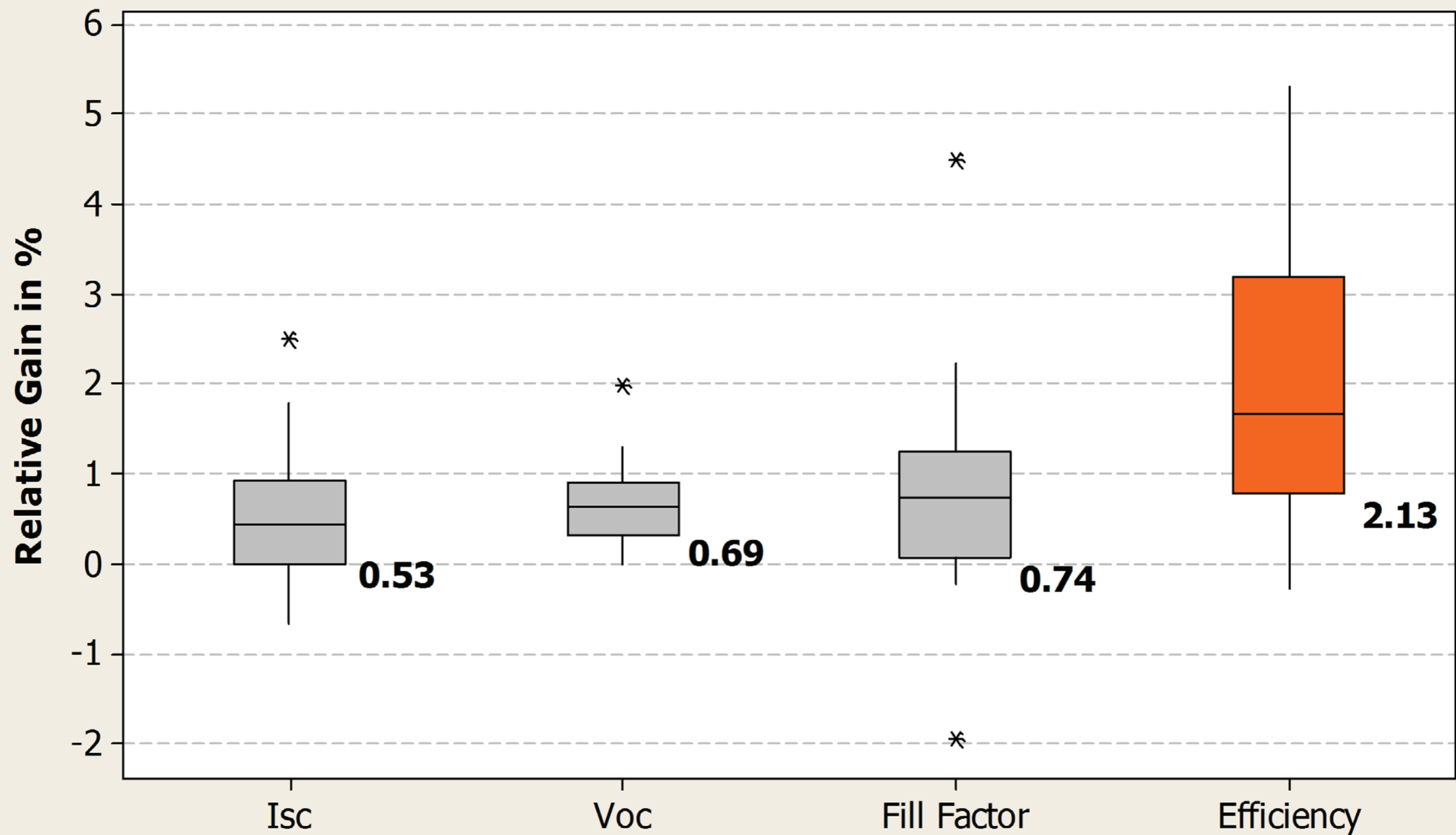
- ◆ Heat can re-crystallize and burn-out defects in the silicon surface or bulk

Post Firing Anneal Efficiency Gain



Efficiency gain after post-firing anneal for different anneal conditions

Relative Gain after Post Firing Anneal



Relative gain after post-firing anneal for the most important cell metrics.

TESTS HAVE SHOWN THAT AN EFFICIENCY GAIN OF UP TO 0.8% ABSOLUTE IS POSSIBLE. THE AVERAGE GAIN WAS 0.3% ABSOLUTE.

This improvement is due to an improvement in all cell characteristics as shown in the graph. Since the post-firing anneal primarily has an effect on the SiN passivated front side of a standard cell it is expected that the effect would be even larger on double sided passivated cells.

The key to maximizing Post-Firing Anneal gains is a high degree of profile flexibility. This profile flexibility can be achieved via the use of infrared lamps. Low cost of ownership is possible while maintaining low oxygen levels (<100ppm) by using small amounts of forming gas.