

# Silicon Solar Cells with Front Hetero-contact and Aluminum Alloy Back Junction

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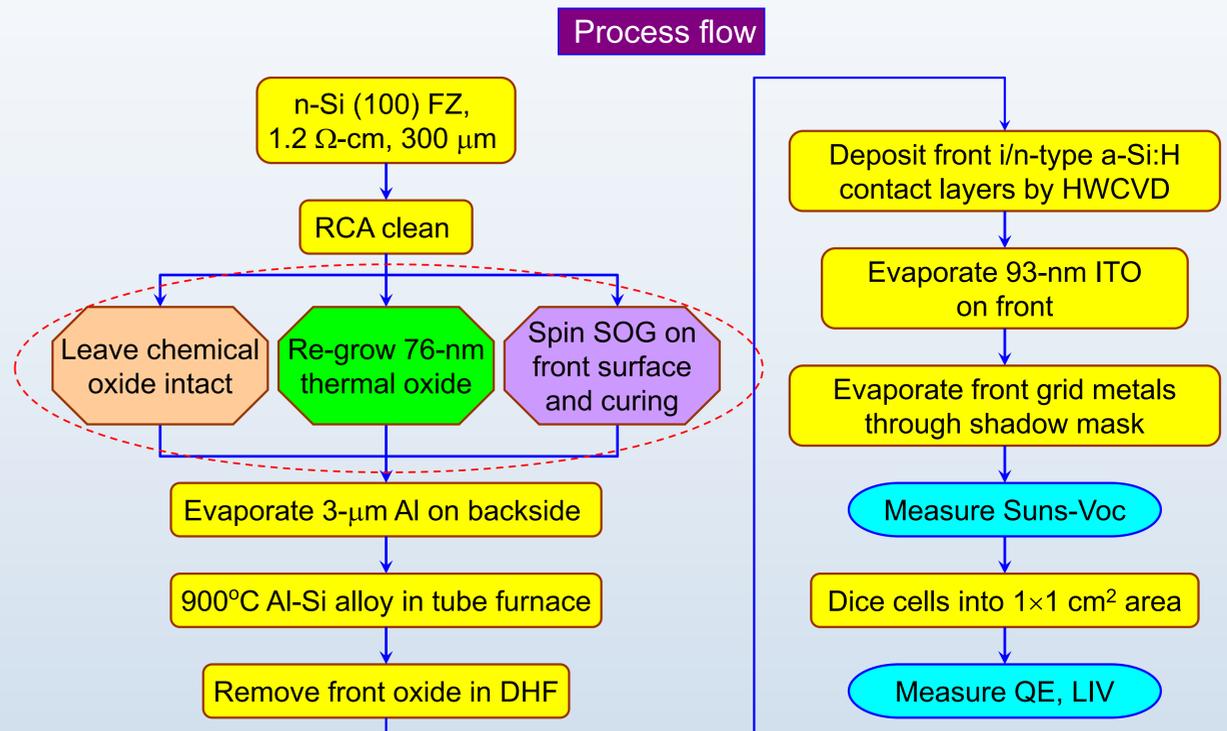
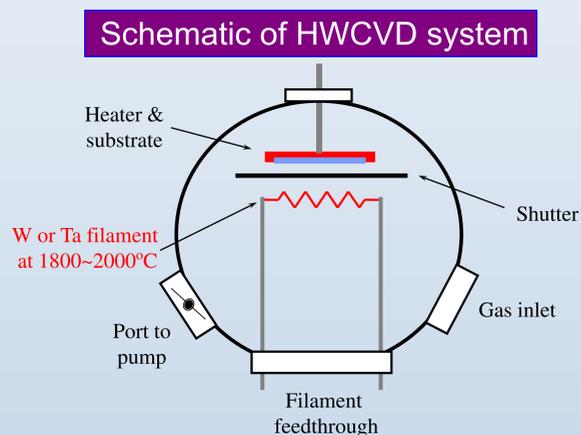
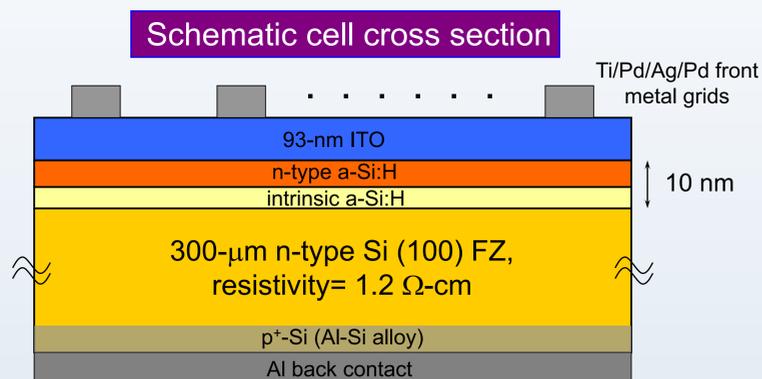
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## I. Objective:

- To apply industrial back Al process in efficient n-wafer cells
  - with a-Si:H front surface passivation
- To evaluate the surface recombination velocity (SRV) of the a-Si:H passivated front surface with different surface preparation procedures

## II. Experiment:

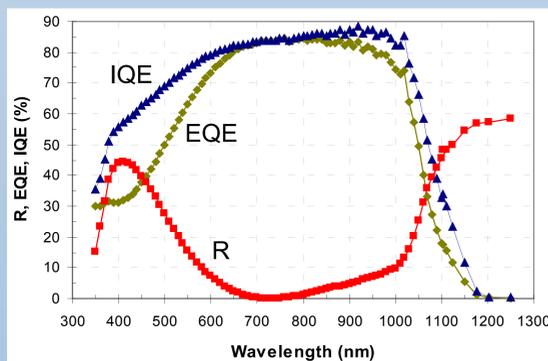


Three surface preparation procedures were studied to evaluate the effectiveness of preserving the clean Si surface until a-Si:H deposition.

## III. Results:

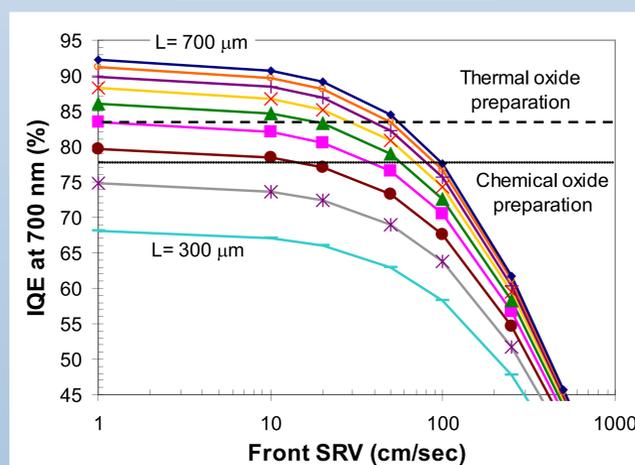
### Summary of Suns- $V_{oc}$ and IQE

Front surface preparation	Leave chemical oxide intact	Re-grow 76-nm thermal oxide	SOG on front
Suns- $V_{oc}$ (mV)	611	617	548
IQE at 700 nm (%)	77.7	83.4	—



- Thermal oxide is most effective for preserving the cleanliness of the c-Si surface through the high-temperature Al-Si alloying.

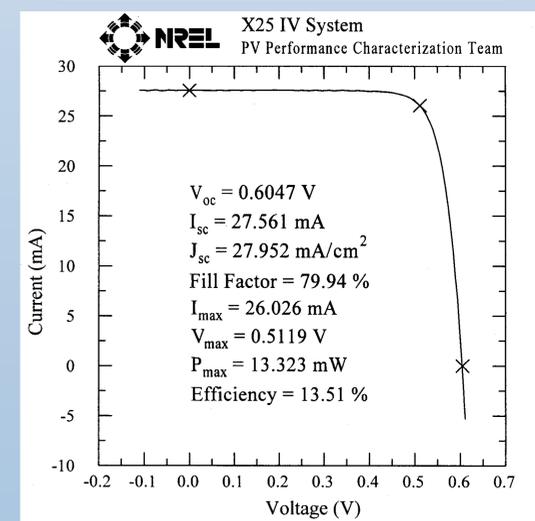
### PC1D simulated IQE



Simulation suggests finished cells have

- diffusion length better than 450  $\mu\text{m}$
- front SRV of thermal oxide prepared surface between 10-50 cm/s
- front SRV of chemical oxide prepared surface twice as high

### Certified IV on present status



- $V_{oc} = 604.7\text{ mV}$
- $J_{sc} = 27.9\text{ mA/cm}^2$
- FF = 79.9%
- $\eta = 13.5\%$

## IV. Summary:

- An alternative cell structure that incorporates front a-Si:H hetero-contact and Al-Si alloy back junction is demonstrated for the first time.
- Thermal oxide effectively preserves the cleanliness of the c-Si through the high-temperature Al-Si alloying for a-Si:H passivation.
- Front SRV of the a-Si:H passivated surface prepared by thermal oxide is between 10-50 cm/s and is close to that on SHJ cell fabricated at low temperature.
- 13.5% conversion efficiency is demonstrated on planar cell with single-layer anti-reflection coating.