Quality Control in the Module Production

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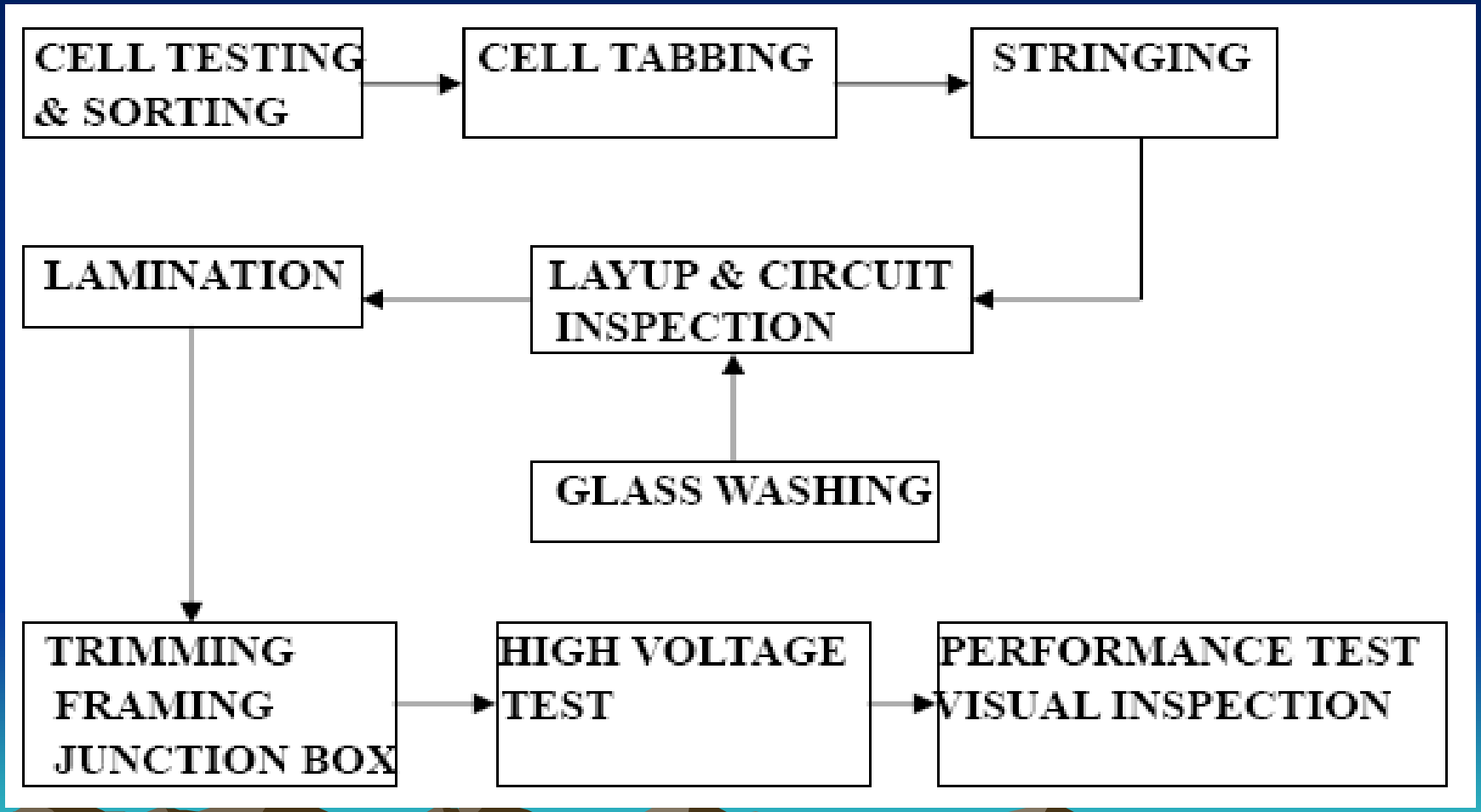
一、Process sequence of crystalline silicon solar module



The general standard for solar modules

(1) Visual inspection

(2) Insulation test

(3) Performance test

(4) Energy production forecast

(5) Reliability (30 years)

For module factory, system builder and user, The reliability of modules is very important, the reliability influence cost payback time (10-12 years cost payback period)

三、IQC

1 Cell testing and sorting

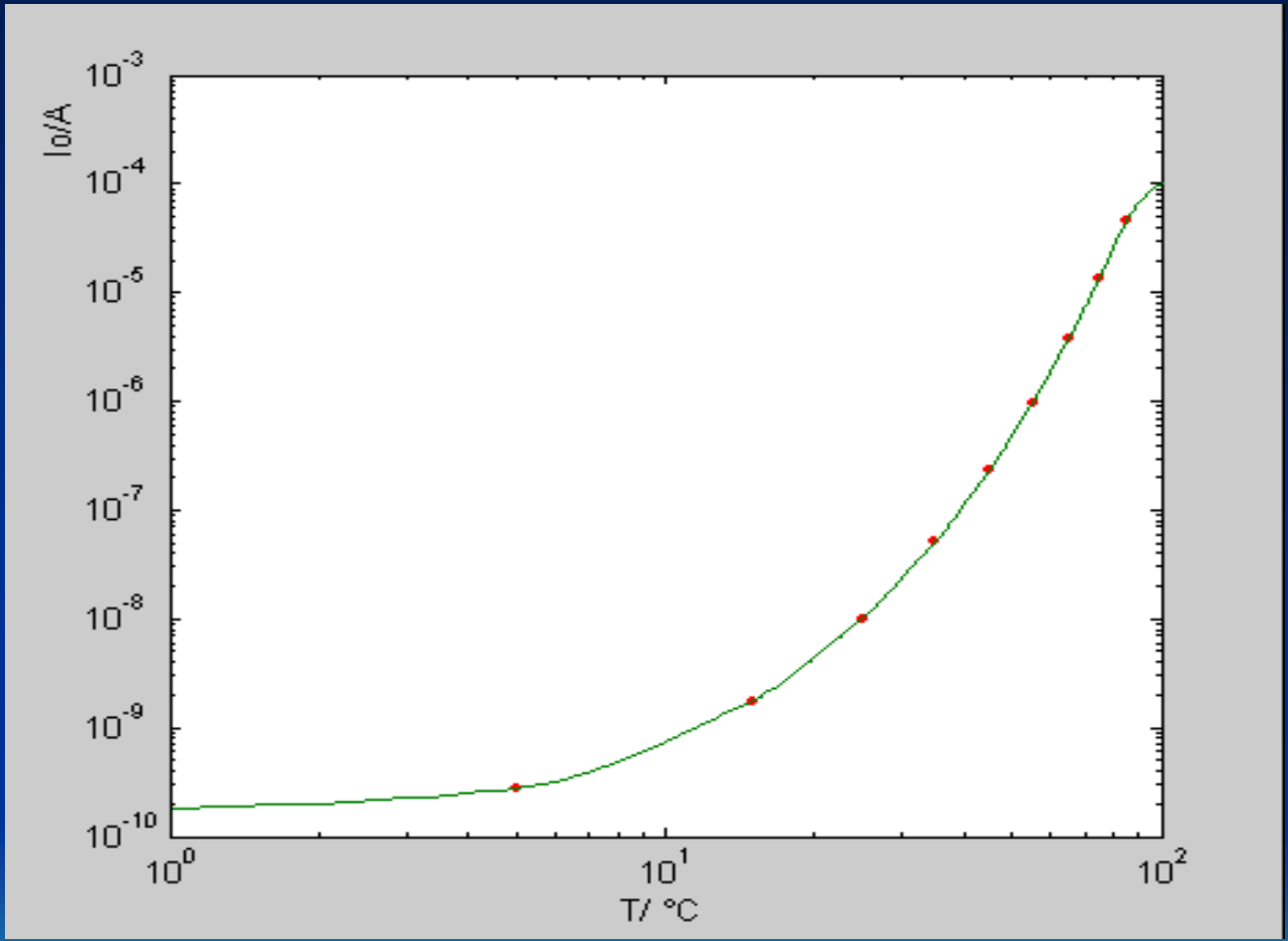
（1）Efficiency under STC (very narrow efficiency classes)

（2）Current measurement at 0.5V under STC（I-V curve step）

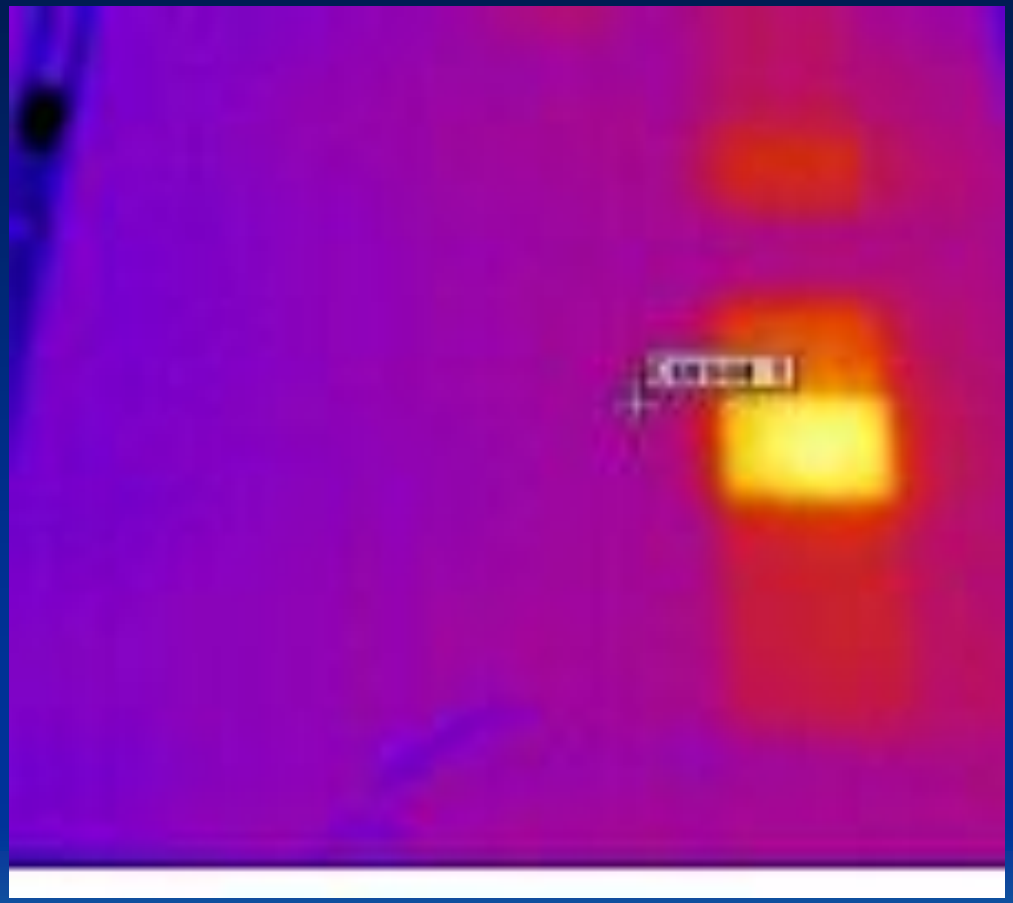
（3）Current measurement at 0.5V under Non-STC

（4）Shunt resistance testing（1500Ω・cm^2）

（5）Reverse current testing



Saturation versus temperature

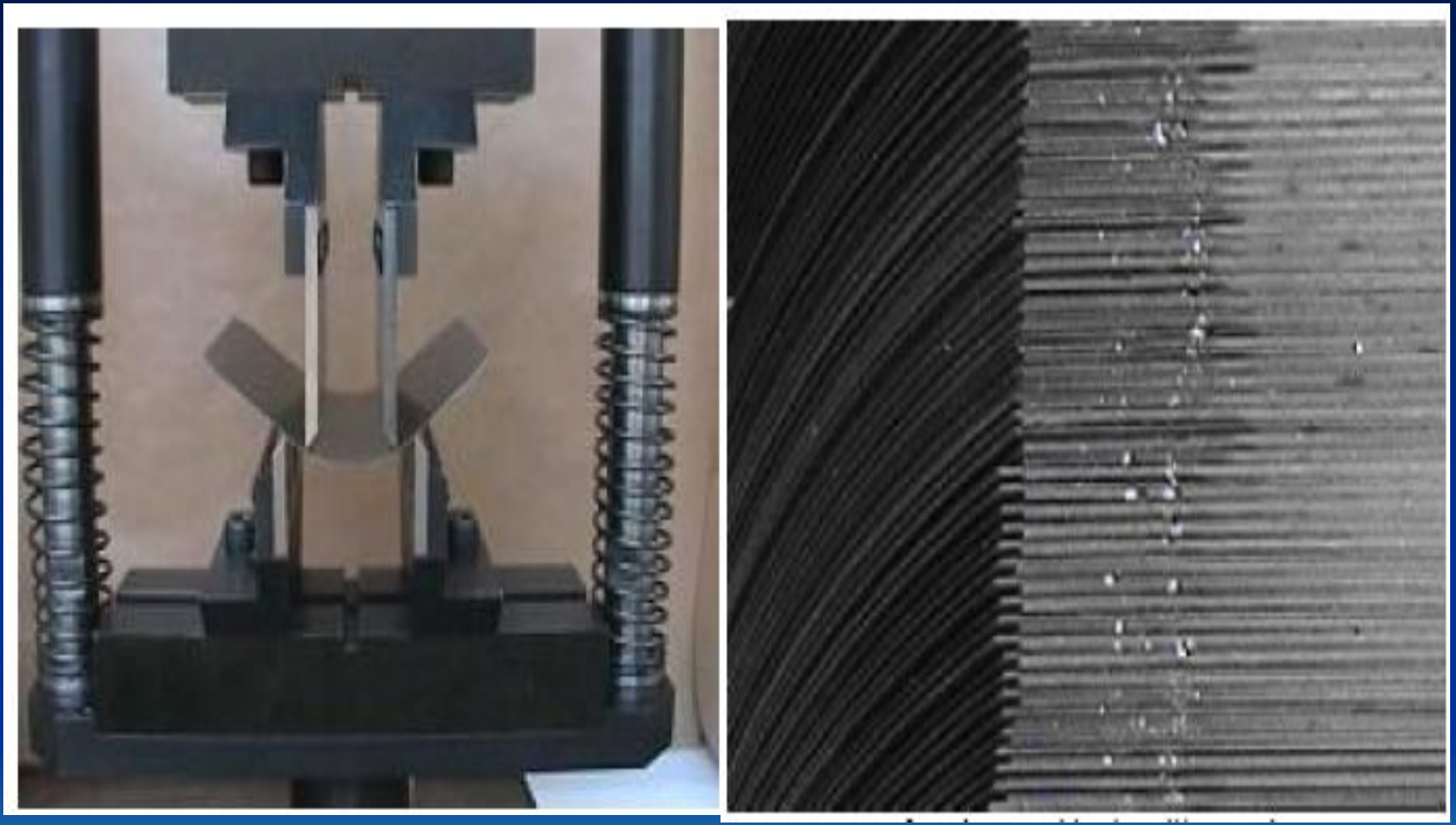


Effect of reverse current on module

（6）Micro-crack check-up

（7）Colour sorting (LC, MC, DC)

（8）Mechanical conformity (Avoidance of chipping, bowing, thickness variance and other off specs)



Micro-crack propagation (from E.Cereceda, et al.22nd EPSEC)

2 EVA

（1）transparency(91%) and anti-browing

（2）EVA and glass peel strength, EVA and TPT peel strength (not less than 20N/cm)

（3）Not reaction to edge sealant

（4）water vapor transmission（0.1wt%)

(5) Crosslinking agent

3 TPT

（1）TPT and EVA peel strength (not less than 20N/cm)

（2）Peel strength of layers (not less than 4N/cm)

（3）Breakdown voltage(18KV)

4 Junction box

（1）Electrical contact

（2）heat sink

（3）Strength of adhensive

（4）Aging of junction box

5 Aluminium frame

（1）Stability of performance

（2）Strength

4 Glass

（1）Flat glass——Textured low iron glass——coated glass

（2）Transparency

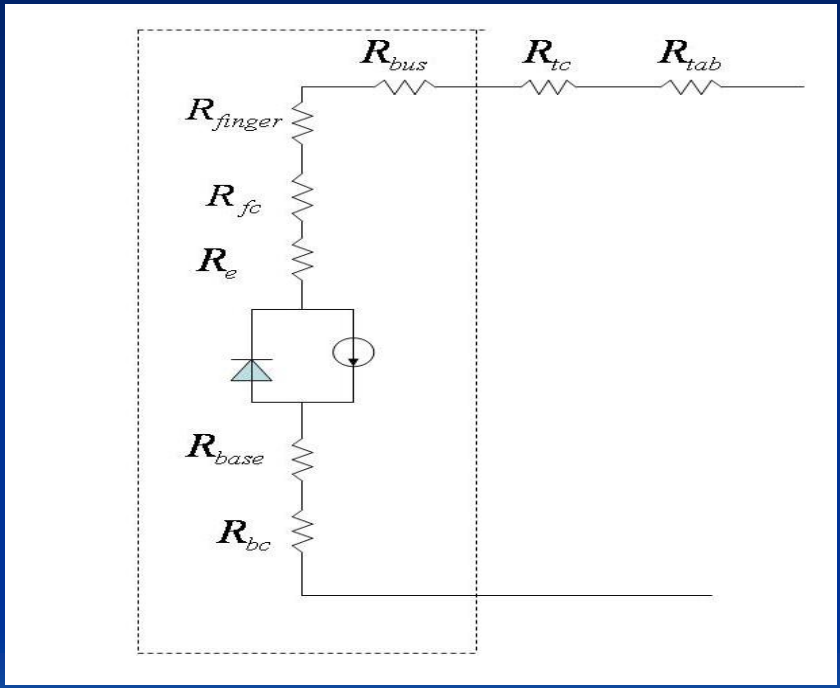
（3）Absorbing UV light

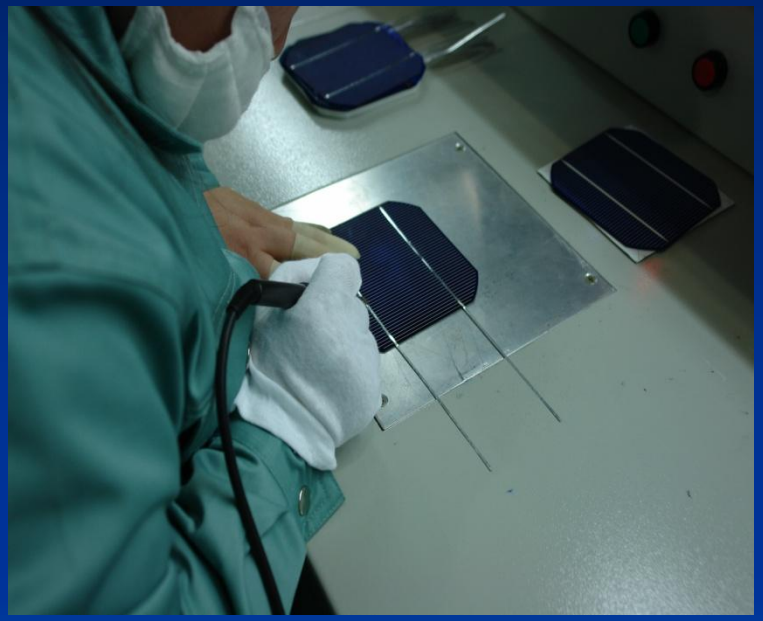
（4）Safety

（5）Glass and EVA peel strength

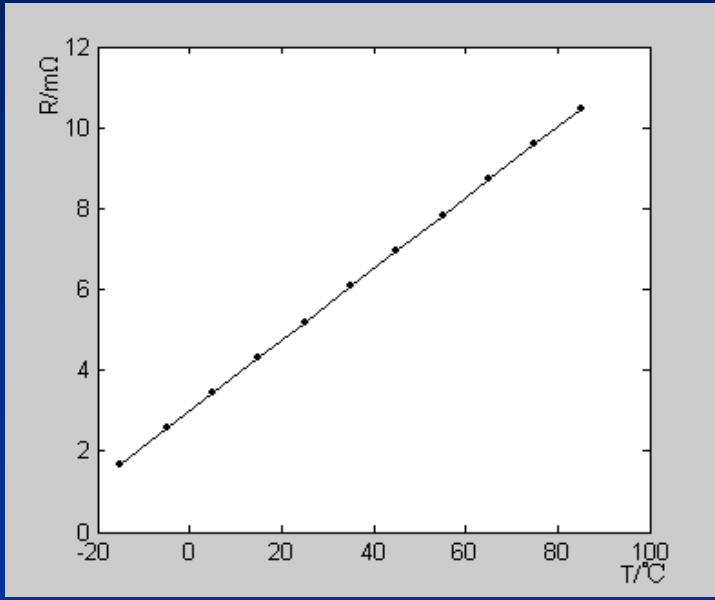
三、IPQC

1 Cell tabbing

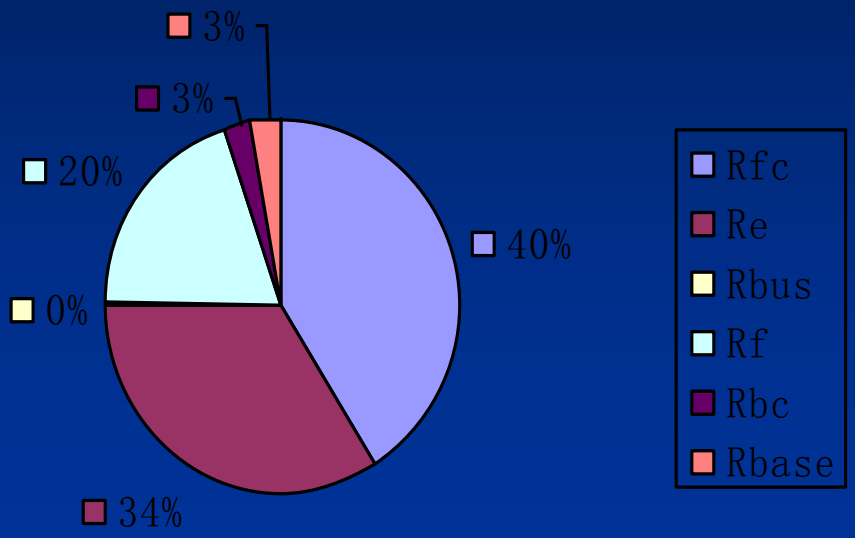




$$R_{tab} = \rho_{tab} \frac{L}{w_{bus} h_{tab}} \qquad R_{tc} = \frac{R_{solder}}{w_{bus} \times L}$$



Series resistance versus temperature



Distribution of cell series resistance

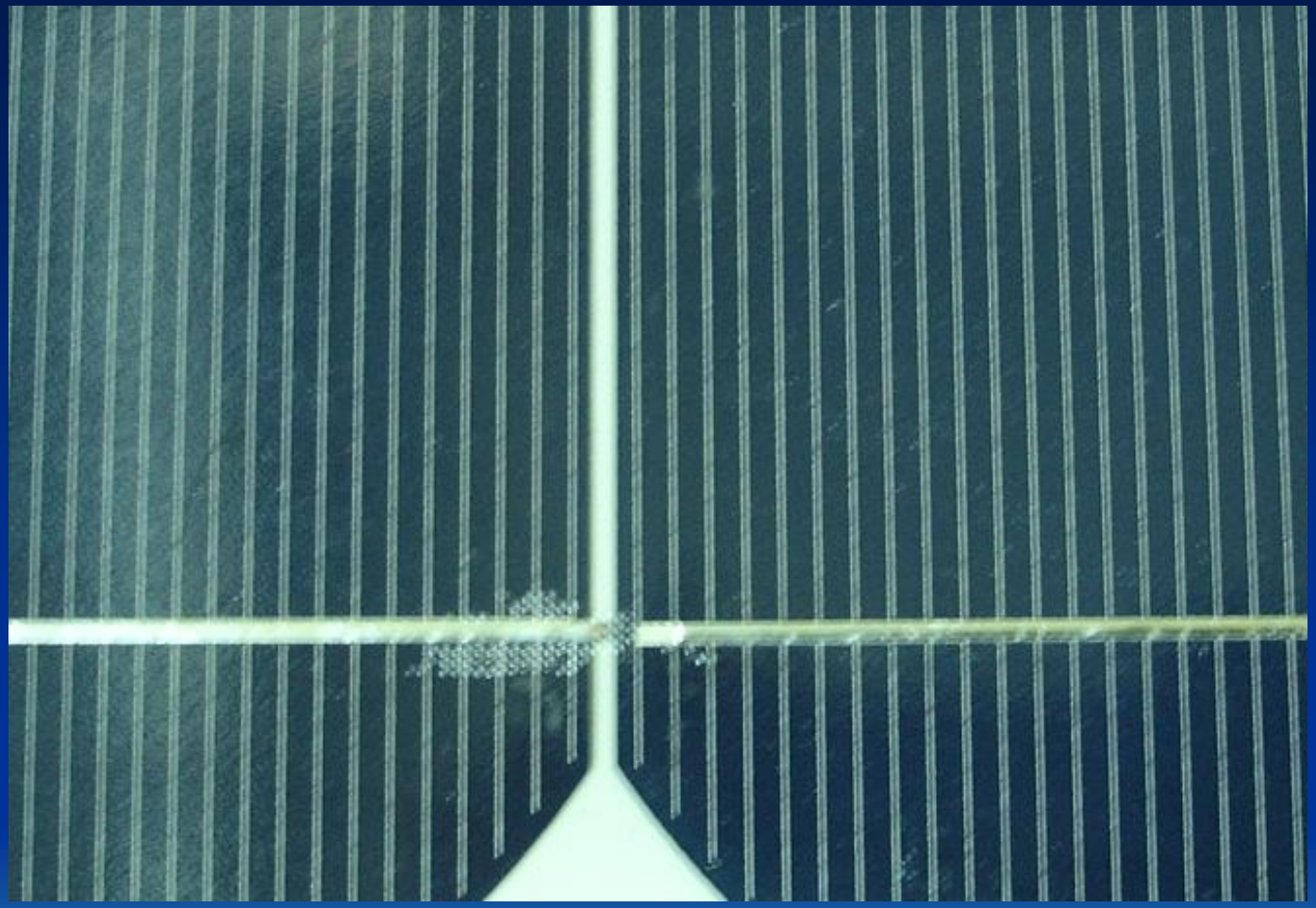
（1）The solder contact resistance lie between 20-80uΩcm^2 , alloy percentage :>80%

（2）Busbar peel strength not less than （0.4N/mm^2)

（3）Pre-bending of SnPb coated copper stripe

（4）Flux（safety, white spot）

（5）Low stress soldering, breakage rate and latent crack



White spot induced by flux

2 Cell stringing