Hamamatsu Visual Inspection Criteria for the ATLAS SCT Detectors

5th October 2001

Hamamatsu identifies that the most vulnerable regions to the scratches, scars, or foreign material are the p-n (or n-n) junctions which are reaching the surface of silicon wafer. These are the edges of strips, bias- and guard-ring, and the boundaries of wide area implantation in the "sensor-edge" regions. The other area with or without implantation or diffusion are less vulnerable. For example, the scratches that are crossing the strips are more vulnerable than those bounded within a strip.

In classifying the foreign materials, the common materials making the sensor, such as Al, Poly-silicon, and SiN, are not counted as the foreign materials. Defects caused by these common materials are counted towards the standard defects.

The visual inspection criteria are defined according to the vulnerability. The inspection will be made with naked eyes first and then the candidates will be checked with microscopes, and rejected if the following criteria are met.

A) Strip region

The structure of strips is, from the top, passivation (other than bonding pads), Al metal, insulation, implantation.

1) Scratches / scars in the passivation layer
a) longer than 2 mm, and
b) deep enough to reveal the insulation layer passing through the Al metal, or
c) short-circuiting or disconnecting Al metals more than 8 strips in a row

2) Scratches / scars in the Al layer
a) longer than 2 mm, and
b) deep enough to reveal the insulation layer underneath, or
c) short-circuiting or disconnecting Al metals more than 8 strips in a row

3) Scratches / scars in the layer below the Al layer
a) longer than 2 mm, or
b) short-circuiting or disconnecting implanted strips more than 8 strips in a row (any smaller number of strips is counted towards the total number of bad strips)

4) Foreign materials
a) not removed with a clean-air blow, e.g., Microduster from Texwipe company, and
b) a single area larger than 0.01 mm^2, or
c) total area larger than 0.1 mm^2

B) Bias- and guard-rings, and sensor-edge region

The bias- and guard-rings, and sensor-edge region are made, from the top, of passivation, Al metal, insulator (other than the bias to implantation), implantation.

1) Scratches / scars in the passivation layer
a) longer than 2 mm, and
b) deep enough to reveal the insulation layer passing through the Al metal, and
c) cross the p-n (or n-n) junction edge

2) Scratches / scars in the Al layer
a) longer than 2 mm, and
b) deep enough to reveal the insulation layer underneath, and
c) cross the p-n (or n-n) junction edge

3) Scratches/scars in the layer below the Al layer
a) longer than 2mm, and
b) cross the p-n (or n-n) junction edge

4) Peeling of Al metalization
a) larger than 1 mm^2

5) Foreign materials
a) not removed with a clean-air blow, e.g., Microduster from Texwipe company, and
b) total area larger than 1 mm^2

C) Backside

The backside is made of diffusion and metalization with Al. Generally, because of the depth of the diffusion, the backside is tolerable to light scratches.

1) Scratches / scars in the Al layer
a) longer than 2mm, and
b) deep (depth > 10 _m) in the silicon bulk underneath the Al

2) Peeling of Al metalization
a) larger than 25 mm^2

3) Foreign materials
a) not removed with a clean-air blow, e.g., Microduster from Texwipe company, and
b) total area larger than 1 mm^2, and
c) buried in the aluminium metalization, or
d) sticking out more than 40 micron

D) Others

1) Poly-silicon resistors
All resistor area are checked visually with microscope.
a) deformation, disconnection or short-circuiting more than 8 channels in a row. Less than 8 channels are counted towards the NG channels

2) Dicing edges
All 4 dicing edges are checked visually with microscope
a) chipping or cracking wider than 50 microns on front or backside edges
b) dicing over aluminium
c) loose edge debris wider than 10 microns and longer than 50 microns (the size being tentative)

3) Fiducial marks
All fiducial marks are checked visually with microscope
a) deformation or defect larger than 5 microns