Abstract for EDNANO 6 – 2008 Workshop, November 27th – 29th, 2008

Applications of electro plating in future solar cell fabrication

Bernd Bitnar, Andreas Krause
SolarWorld AG, Berthelsdorfer Str. 111 A, D-09599 Freiberg, Germany

The efficiency of solar cells has to be increased drastically to reache grid parity. Considering this, the optimization of the front side and backside metallization is an important issue.
In the mostly applied standard solar cell fabrication process, metallisation is carried out by screen printing. The rear contact of an industrial solar cell is made by a full area Al contact, which forms during a final high temperature annealing step a strongly p-doped region underneath. This highly doped region improves the electrical contact of the layer to the p-doped Si and reduces recombination of charge carriers. On the front side a grid structure with typically 100 – 130 µm wide fingers is formed by screen printing on top of a dielectric antireflexion coating. During the same annealing step that improves the rear contact, the front grid is etched through the antireflexion layer and forms the electrical contact to the n-doped emitter.

The aim of the present paper is to discuss metallization concepts for future solar cells and to point out the important role electro plating could play.

The focus in improving the solar cell metallization technology is fabricating smaller and higher fingers as it is possible with the present screen printing technique to reduce the shadowing losses. Furthermore, expensive Ag used for the front grid formation could be replaced by less expensive materials like Cu. In addition, materials that are able to contact Si with a lower surface doping concentration are in the focus of research. An example is Ni, which forms a NiSi layer after annealing at moderate temperatures.

It is suggested to improve the standard screen printing front contact by printing a thin Ag grid as a seed layer followed by a plating step including the growth of a Cu conducting layer on top of the grid. In a more sophisticated cell concept, the antireflexion layer is opened locally by a laser process forming a grid structure with very narrow opening lines to the Si. In these lines a plating process is applied depositing Ni and Cu. Using a suitable annealing step a NiSi layer is formed, which gives a good electrical contact to the emitter, even by the presence of only low surface doping levels.

For the rear contact formation, plating is discussed to improve the solderability compared to the screen printed contact. For a better electrical performance of the cells, a local contact on the rear side is favored over the full area Al contact. This structure could easily be formed by plating.