Solar Technology | Photovoltaics | Technology Offer

Silver-free, nickel-containing paste for establishing contacts in solar cells

Field of Application

The process is suitable for the industrial fabrication of solar cells, in particular the electrical contacts on the front side of solar cells. Using a silver-free, nickel-particle containing and corrosive print paste reduces costs of material, process steps and the risk of degradation.

State of the Art

The print paste which is applied to the front of the solar cell during its fabrication is normally composed of silver particles, glass frit and organic elements. The paste is then fired into the silicon substrate to establish the electrical contact.
This approach is costly because it requires both a high energy input and silver. Earlier attempts to use nickel instead of silver were abandoned because it proved highly complex. Current solutions which are implemented in the laboratory setting also require several processing steps and thus are not economically viable in an industrial setting. The standard method currently in use also has a technical downside in that the contact resistance between silver particle and silicon is not optimal.

Innovation

A print paste consisting of nickel particles and a corrosive component was developed at the University of Constance. The corrosive component can be adapted to the material of the passivation layer so that the passivation layer is locally dissolved. Through the opening of the passivation layer the nickel particles come in direct contact with the surface of the silicon substrate.
Specifically, at temperatures of 350 °C to 550 °C, nickel silicide is formed at the point of contact. The contact resistance is significantly lower than that of the silver/ silicon contact.
The print paste allows the formation of contacts at moderate temperatures of less than 500 °C because the firing and the associated peak temperatures are no longer needed. This reduces the risk of negatively modifying the passivation layer. The silver-free paste is particularly suited for the new multi-busbar design and leads to significantly lower production cost of photovoltaic modules.
Furthermore, it is possible to strengthen the nickel/ nickel-silicon layer, for example with copper or tin.

Advantages

- ✓ Reduction in costs by using nickel instead of silver
- ✓ Reduced contact resistance
- ✓ Lower processing temperatures
- ✓ Reduced risk of degradation
- ✓ Chemical etching of the dielectric layer and formation of metal contact in single processing step

Figure 1: Solar cells

Technology Transfer

The Technologie-Lizenz-Büro GmbH is charged with the commercialisation of this technology and now offers enterprises the possibility of a technology licence to allow them to exploit this break-through.

Patent Portfolio

German Patent DE 10 2011 016 335 granted.

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