

There was therefore still a need for a simple way of reducing the sintering times and/or sintering temperatures of coatings containing silver nanoparticles, in order to decrease the thermal stress on plastic substrates, while at the same time achieving a conductivity which is sufficient for the application.

5 Summary

In a first aspect of the present disclosure, there is provided a metal nanoparticle sol having a metal particle content ≥ 1 g/l, containing

- silver nanoparticles
- at least one polymeric dispersant and
- 10 - at least one liquid dispersion medium

wherein the metal nanoparticle sol contains from 0.1 to 10 wt% of at least one metal selected from the group consisting of: ruthenium, rhodium, palladium, osmium, iridium and platinum, expressed in terms of the silver content of the metal nanoparticle sol, in the form of the metal or at least one metal compound.

15 In a second aspect of the present disclosure, there is provided a method for producing a metal nanoparticle sol as defined above, wherein

a) a silver salt solution, a solution containing at least one metal salt of a metal selected from the group: ruthenium, rhodium, palladium, osmium, iridium and platinum, and a solution containing hydroxide ions are combined,

20 b) the solution obtained from step a) is subsequently reacted with a reducing agent,
at least one of the solutions in step a) containing at least one dispersant, characterized in that the three solutions are combined simultaneously in step a).

In a third aspect of the present disclosure, there is provided the use of a metal nanoparticle sol as defined above for the production of conductive printing inks.

25 In a fourth aspect of the present disclosure, there is provided the use of a metal nanoparticle sol as defined above for the production of conductive coatings or conductive structures.

Description

It was therefore an object of the present invention to find a metal particle sol containing silver nanoparticles, and a method for its production, with which the sintering times and/or sintering temperatures necessary for achieving sufficient conductivities can be reduced so that a thermal stress, in particular on plastic substrates, can be decreased.

Surprisingly, it has been found that doping the silver nanoparticles with a content of from 0.1 to 10 wt% of a metal selected from the group: ruthenium, rhodium, palladium, osmium, iridium and platinum, expressed in terms of the silver content of the metal particle sol, in the form of the metal or at least one compound of such a metal significantly reduces the sintering time which is necessary in order to achieve a sufficient conductivity. The sintering times can be reduced by up to 80% in this case, which leads to considerable thermal stress relief in particular for thermally sensitive plastic substrates, and at the same time can widen the available range of possible plastic substrates to be coated with such conductive structures. As an alternative, using comparable sintering times, significantly higher conductivities can be achieved with the metal particle sols according to the invention than with known silver nanoparticle sols without the corresponding doping.

The present invention accordingly provides a metal nanoparticle sol having a metal nanoparticle content ≥ 1 g/l, containing

- silver nanoparticles
- at least one dispersant and
- at least one liquid dispersion medium

characterized in that the metal particle sol contains from 0.1 to 10 wt% of at least one metal selected from the group: ruthenium, rhodium, palladium, osmium, iridium and platinum, expressed in terms of the silver content of the metal nanoparticle sol, in the form of the metal and/or at least one metal compound.

Preferably, the content of the metal selected from the group: ruthenium, rhodium, palladium, osmium, iridium and platinum, in the form of the metal and/or at least one metal compound,