Supply system for chemicals and its use

The present invention relates to a novel supply system for chemicals which permits the preparation of solid-containing suspensions, which are required, inter alia, for polishing wafers or in semiconducter production, directly at the point of use.

Typical semiconductor circuits are usually produced by using silicon or gallium arsenide as a substrate, on which a large number of integrated circuits are applied. The various layers from which these integrated circuits are produced are either conducting or insulating or have semiconductor properties. In order to produce such a semiconductor structure, it is essential for the wafer used to have an absolutely level surface. It is therefore frequently necessary to polish the surface or a part of the surface of a wafer.

Further developments in semiconductor technology have led to greater and greater integration depths and a progressive miniaturization combined with increasingly small semiconductor structures, with the result that the manufacturing methods have to meet growing requirements. In such semiconductor elements, it is necessary, for example, to form thin conductor tracks or similar structures on structures formed beforehand. Problems arise because the surface of the structures formed beforehand is frequently irregular. In order to be able to obtain a satisfactory result in the subsequent photolithographic treatment, the surface must therefore be made planar.

The methods and means by which repeatedly necessary planarity is achieved are therefore a key subject in semiconductor production. The technical term used for this process is chemical-mechanical polishing. Accordingly, both the technical apparatuses used and the chemical components used of which the formulations of the polishing suspensions used are composed, as well as the supply systems with the aid of

which the latter are provided during polishing, are therefore of considerable interest in this process step.

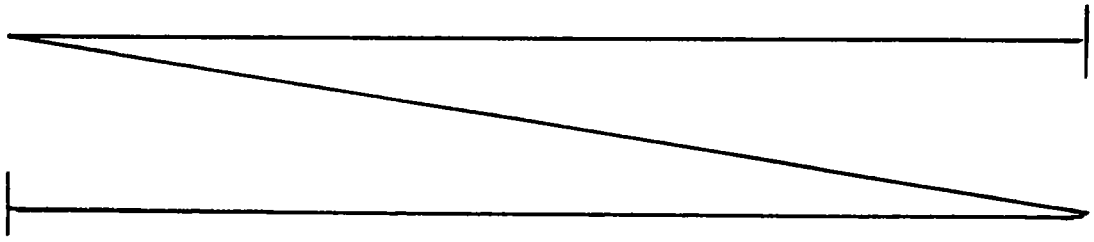
In general, chemical-mechanical polishing (CMP) is carried out by polishing the rotating wafer under uniform pressure with a polishing pad which is uniformly impregnated with a polishing suspension.

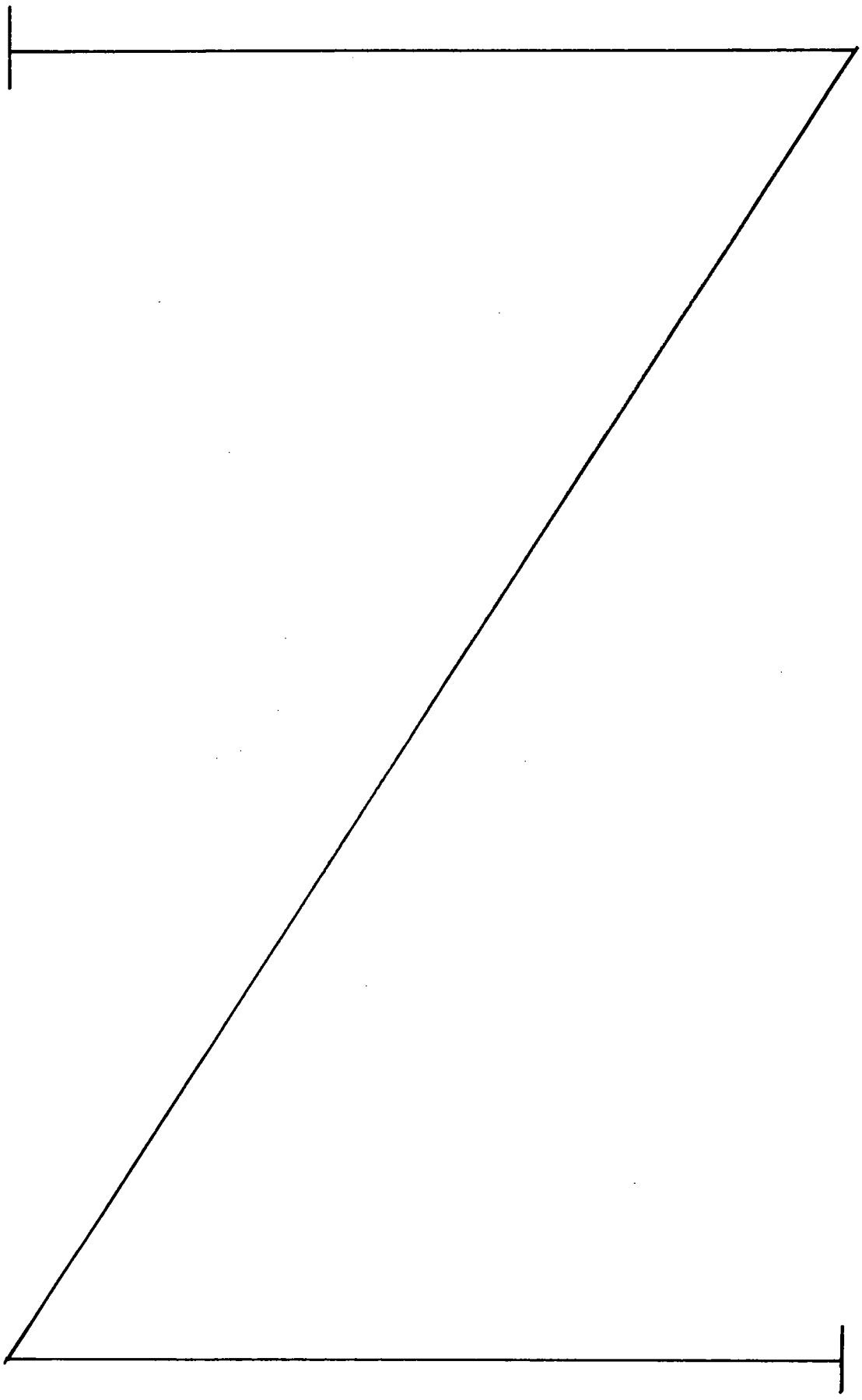
In semiconductor production, chemical-mechanical polishing steps are also being used to an increasing extent. They serve for imparting planarity to metallizing tracks on silica layers or other surface structures on wafers. Special CMP slurries, i.e. abrasive, liquid media, are used in this connection. These media must be combined by means of supply systems for chemicals. It is particularly important that these supply systems are capable of providing continuously at the point of use suspensions having constant properties, i.e. in particular having a constant concentration of solid particles and a constant average distribution of the particle diameters. The latter is of particular importance since uniform polishing results are dependent thereon.

Corresponding systems known to date to a person skilled in the art meet the technical requirements only to a limited extent, if at all.

A particular problem arises out of the considerable sedimentation in the solid-containing suspensions, possibly during storage but in particular also in pipelines which lead to the point of use, so that considerable problems may arise with regard to transport and use of raw materials and of the prepared suspensions in the supply system.

[NOT TO BE TAKEN INTO ACCOUNT FOR THE PURPOSE OF INTERNATIONAL PROCESSING]





Laying of the pipelines in a descending manner makes it possible, in the case of faults, such as, for example, in the event of power failure or insufficient flow rate in the pipelines, to convey chemicals or mixtures thereof back to storage tanks under the action of gravity. If necessary, the chemicals or mixtures thereof can be conveyed back to storage tanks by application of compressed air.

To avoid contaminations during the operation, the system can be subjected to pressure, in particular to slightly superatmospheric pressure of about 0.3 to 5 bar.

According to the invention, all system components coming into contact with the chemicals used are produced from materials which are inert to both strongly acidic and strongly basic oxidizing media. Preferably, these components are produced from materials which are resistant to chemicals and are selected from the group consisting of the completely or partially fluorinated or nonfluorinated polymeric hydrocarbons. The choice of the materials used is based on the condition that highly pure chemicals used must not suffer any losses of quality due to abrasion or dissolution of undesired particles.

In particular, this supply system can be used for the preparation of suspensions for chemical-mechanical polishing.

In an embodiment according to the invention, it is suitable in particular for the direct supply of suspensions for chemical-mechanical polishing at the point of use, preferably for the preparation of suspensions for chemical-mechanical polishing which are required for the production of wafers or semiconductor circuits.

The present invention also relates to a process for operating the supply system, in which

a) one or more metered amounts of solid are taken in one or more intermediate containers and

b) are converted into a pasty or liquid form with mixing, by adding one or more liquids, and

c) are introduced into one or more storage or working tanks in which, if required, further chemicals required in the operation have already been placed.

PATENT CLAIMS

1. Supply system for chemicals during chemical-mechanical polishing, characterized by a system consisting of

a) storage and working tanks which are connected to one another and which, if required, are provided with stirrers or other apparatuses for homogeneous mixing and, if required, can be subjected to pressure,

b) by pipelines which are provided with valves, are laid in a descending manner and, if required, can be subjected to pressure,

c) if required, a compressed air supply suitable for highly pure chemicals

and

d) if required, a system for supplying highly pure water.

2. Supply system according to Claim 1, characterized in that pipelines in which solid-containing media are conveyed are provided with static mixers.

3. Supply system according to one or both of the preceding claims, characterized in that laying the pipelines in a descending manner makes it possible to convey chemicals or mixtures thereof back to storage tanks by the action of gravity.

4. Supply system according to one or more of the preceding claims, characterized in that chemicals or mixtures thereof can be conveyed back to storage tanks by application of compressed air.

5. Supply system according to any of Claims 1 to 4, characterized in that it can be subjected to pressure during the operation in order to avoid contaminations.

6. Supply system according to Claim 5, characterized in that it operates at a slightly superatmospheric pressure of 0.3 to 5 bar.

7. Supply system according to one or more of the preceding claims, characterized in that all system components coming into contact with the chemicals used are produced from materials which are inert to both strongly acidic and strongly basic oxidizing media, so that contamination of the chemicals by abrasion or dissolution of particles is avoided.

8. Supply system according to Claim 7, characterized in that all system components coming into contact with the chemicals used are produced from materials which are resistant to chemicals and are selected from the group consisting of the completely or partially fluorinated or nonfluorinated polymeric hydrocarbons.

9. Use of the supply system according to one or more of the preceding claims for the preparation of suspensions for chemical-mechanical polishing.

10. Use of the supply system according to one or more of Claims 1 to 8 for directly supplying suspensions for chemical-mechanical polishing at the point of use.

11. Use of the supply system according to one or more of Claims 1 to 8 for the preparation of suspensions for chemical-mechanical polishing which are required for the production of wafers or of semiconductor circuits.

12. Process for operating a supply system according to one or more of Claims 1 to 8, characterized in that

a) one or more metered amounts of solid are taken in one or more intermediate containers and

b) are converted into a pasty or liquid form with mixing, by adding one or more liquids, and

c) are introduced into one or more storage or working tanks in which, if required, further chemicals required in the operation have already been placed.