US 2007/176141 A1 discloses an aqueous composition useful for polishing silica and boro-phosphate-silicate-glass on a semiconductor wafer comprising carboxylic acid polymer, abrasive, polyvinylpyrrolidone, cationic compound, zwitterionic compound and balance water, wherein the polyvinylpyrrolidone has an average molecular weight between 100 grams/mole to 1,000,000 grams/mole.

JP 2006/041033 A2 discloses a CMP technology for planarizing an interlayer insulating film, BPSG film, or insulating film for shallow-trench isolation. The CMP composition contains cerium oxide particles, dispersants, water soluble polymers, and water. The water soluble polymer is obtained by polymerization of a monomer containing an unsaturated carboxylic acid or its salt using an azo compound – either anionic or amphoteric – or its salt as polymerization initiator.

One of the objects of the present ~~invention~~disclosure was to provide a CMP composition and a CMP process appropriate for the chemical-mechanical polishing of BPSG and showing an improved polishing performance, particularly a high material removal rate (MRR) of BPSG, or an appropriate selectivity of BPSG to silicon oxide (referred to as "BPSG:oxide selectivity" in the following) with regard to MRR of less than 1:1 – for example a selectivity of BPSG to tetraethyl orthosilicate (TEOS) with regard to MRR in the range of from 0.5:1 to 1:1 –, or the combination of high BPSG-MRR and an appropriate BPSG:oxide selectivity with regard to MRR of below 1:1. Furthermore, one of the objects of the present ~~invention~~disclosure was to provide a CMP composition and a CMP process appropriate for the chemical-mechanical polishing of BPSG material as part of a substrate comprising silicon oxide – for example TEOS –, silicon nitride, and polysilicon. Moreover, a CMP process was sought that is easy to apply and requires as few steps as possible.

Accordingly, a process for the manufacture of semiconductor devices comprising the chemical mechanical polishing of borophosphosilicate glass (BPSG) material in the presence of a CMP composition comprising:

(A) inorganic particles, organic particles, or a mixture or composite thereof,
(B) at least one type of anionic phosphate or phosphonate as dispersing agent or charge reversal agent,
(C) at least one type of surfactant, and
(D) an aqueous medium.

was found. This CMP composition is referred to as (Q) or CMP composition (Q) in the following.

In a first aspect, there is provided a process for the manufacture of semiconductor devices comprising the chemical mechanical polishing of borophosphosilicate glass (BPSG) material in the presence of a CMP composition comprising: (A) inorganic particles, organic particles, or a mixture or composite thereof, (B) at least one type of anionic phosphate or phosphonate as dispersing agent or charge reversal agent, (C) at least one type of surfactant, and (D) an aqueous medium.

Moreover, the use of the CMP composition (Q) for chemical-mechanical polishing of a substrate comprising BPSG material was found.

In a second aspect, there is provided a use of the CMP composition (Q) for chemical-mechanical polishing of a substrate comprising BPSG material.

Preferred embodiments are explained in the claims and the specification. It is understood that combinations of preferred embodiments are within the scope of the present ~~invention~~disclosure.

A semiconductor device can be manufactured by the process of the ~~invention~~disclosure, said process comprises the chemical mechanical polishing of BPSG material in the presence of the CMP