removal rate due to their rough surface while maintaining the same defectuosity thanks to equivalent size distributions compared to dispersions of smooth surface cerium oxide particles having no shell in accordance with the present invention.

The dispersions of cerium based core-shell particles of the invention can be used to prepare powders of cerium based core-shell particles, as well as polishing compositions, as it will be detailed hereafter in the specification.

Additionally, one advantage of the core-shell particles of the invention is that the nanoparticles from the shell are well attached to the core particle. It has notably been observed that they remain attached to the core during the whole chemical mechanical polishing process in which they are implemented. It is all the more important since the particles shells withstand the mechanical stress during the chemical mechanical polishing process. If the nanoparticles of the shell came off during the polishing, these small cerium oxide particles could remain attached to the substrate even after a washing step, which is not acceptable by the end users. It would result in unacceptable costs due to the substrate loss and the recurrent polishing composition replacement.

Another advantage of the core-shell particles of the invention lies in the fact they have the adapted size range for the CMP application and are monodisperse.

In one aspect, there is provided a polishing composition comprising a dispersion of cerium based core-shell particles as described herein or a cerium based core-shell particles powder as described herein.

In another aspect, there is provided a method of removing a portion of a substrate, the method comprising polishing the substrate with a polishing composition prepared from a dispersion as described herein or from a dispersion prepared from a core-shell cerium oxide particles powder as described herein.

In yet another aspect, there is provided a semiconductor comprising a substrate polished by the method as described herein.

FIGURES

Figures 1 is a TEM picture of a dispersion of the core-shell particles of the invention obtained by the process illustrated in example 1, having a cerium oxide core and a cerium oxide shell.

Figures 2 is a SEM picture of a dispersion of the cerium oxide particles intended to be used as core particles in the process illustrated in example 1.

Figures 3 is a TEM picture of a dispersion of the core-shell particles of the invention obtained by the process illustrated in example 2, having a lanthanum doped cerium oxide core and a cerium oxide shell.

Figures 4 is a TEM picture of a dispersion of the core-shell particles of the invention obtained by the process illustrated in example 3, having a cerium oxide core and a lanthanum doped cerium oxide shell.