COMPOSITE CERAMIC ABRASIVE POLISHING SOLUTION

FIELD

The present disclosure relates to polishing solutions useful for the polishing of substrates, and methods of using such polishing solutions.

BACKGROUND

Various articles, systems, and methods have been introduced for the polishing of ultrahard substrates. Such articles, systems, and methods are described, for example, in E. Kasman, M. Irvin, CS Mantech Conference, May 17-20^ 2010, Portland Oregon; and K.Y. Ng, T. Dumm, CS Mantech Conference, April 23rd-26th, Boston , MA.

SUMMARY

In some embodiments, a polishing solution is provided. The polishing solution includes a fluid component and a plurality of ceramic abrasive composites. The ceramic abrasive composites include individual abrasive particles uniformly dispersed throughout a porous ceramic matrix. At least a portion of the porous ceramic matrix includes glassy ceramic material. The ceramic abrasive composites are dispersed in the fluid component. The fluid component includes ethylene glycol, propylene glycol, glycerol, or oligomers of ethylene glycol.

In some embodiments, a further polishing solution is provided. The polishing solution includes a fluid component and a plurality of ceramic abrasive composites. The ceramic abrasive composites include individual abrasive particles dispersed in a porous ceramic matrix. The amount of porous ceramic matrix in the ceramic abrasive composites is between about 5 and 95 weight percent of the total weight of the porous ceramic matrix and the individual abrasive particles. At least a portion of the porous ceramic matrix includes glassy ceramic material. The ceramic abrasive composites are dispersed in the fluid component. The fluid component includes ethylene glycol, propylene glycol, glycerol, or oligomers of ethylene glycol.

The above summary of the present disclosure is not intended to describe each embodiment of the present disclosure. The details of one or more embodiments of the disclosure are also set forth in the description below. Other features, objects, and advantages of the disclosure will be apparent from the description and from the claims.

WHAT IS CLAIMED IS:

1. A polishing solution comprising:

a fluid component; and

a plurality of ceramic abrasive composites, the ceramic abrasive composites comprising individual abrasive particles uniformly dispersed throughout a porous ceramic matrix;

wherein at least a portion of the porous ceramic matrix comprises glassy ceramic material; ~~and~~

wherein the ceramic abrasive composites are dispersed in the fluid component; and

wherein the fluid component comprises ethylene glycol, propylene glycol, glycerol, or oligomers of ethylene glycol.

2. A polishing solution comprising:

a fluid component; and

a plurality of ceramic abrasive composites, the ceramic abrasive composites comprising individual abrasive particles dispersed in a porous ceramic matrix;

wherein the amount of porous ceramic matrix in the ceramic abrasive composites is between about 5 and 95 weight percent of the total weight of the porous ceramic matrix and the individual abrasive particles;

wherein at least a portion of the porous ceramic matrix comprises glassy ceramic material; ~~and~~

wherein the ceramic abrasive composites are dispersed in the fluid component; and

wherein the fluid component comprises ethylene glycol, propylene glycol, glycerol, or oligomers of ethylene glycol.

3. The polishing solution of any one of the preceding claims, wherein the fluid component is aqueous.

4. The polishing solution of any one of claims 1-2, wherein the fluid component is non-aqueous.

~~5. The polishing solution of any one of the preceding claims, wherein the fluid component comprises ethylene glycol, propylene glycol, glycerol, or oligomers of ethylene glycol.~~

~~6~~5. The polishing solution of any one of the preceding claims, wherein the ceramic abrasive composites have a pore volume ranging from about 4-70%.

~~7~~6. The polishing solution of any one of the preceding claims, wherein the abrasive particles comprise diamond, cubic boron nitride, fused aluminum oxide, ceramic aluminum oxide, heated

treated aluminum oxide, silicon carbide, boron carbide, alumina zirconia, iron oxide, ceria, or garnet.

~~8~~7. The polishing solution of any one of the preceding claims, wherein the abrasive particles comprise diamond.

~~9~~8. The polishing solution of any one of the preceding claims, wherein the ceramic abrasive composites have an average particle size of less than 500 microns.

~~10~~9. The polishing solution of any one of the preceding claims, wherein the average size of the ceramic abrasive composites is at least about 5 times the average size of the abrasive particles.

~~11~~10. The polishing solution of any one of the preceding claims, wherein the porous ceramic matrix comprises glass comprising aluminum oxide, boron oxide, silicon oxide, magnesium oxide, sodium oxide, manganese oxide, or zinc oxide.

~~12~~11. The polishing solution of any one of the preceding claims, wherein the concentration of the abrasive composites in the fluid component is between 0.065% and 6.5% by weight.

~~13~~12. The polishing solution of any one of the preceding claims, wherein the porous ceramic matrix comprises at least 50% by weight glassy ceramic material.

~~14~~13. The polishing solution of any one of the preceding claims, wherein the porous ceramic matrix consists essentially of glassy ceramic material.

~~15~~14. A method of polishing a substrate, the method comprising:

providing a polishing pad;

providing a substrate having a major surface to be polished; and

contacting said surface with the polishing pad and the polishing solution of any one of claims ~~1-14~~1-13 while there is relative motion between the polishing pad and the substrate.

~~16~~15. A polishing system comprising a polishing pad and a polishing solution according to anyone of claims ~~1-14~~1-13.