As described above, a water-containing working fluid is known. When the water content of the known working fluid is increased, however, abrasive grains used in a loose abrasive grain method are apt to sediment so that it becomes difficult to evenly supply the abrasive grains in the working gap. Although the abrasive grains might be expected not to easily sediment by an increase of the viscosity of the working fluid, it becomes difficult to feed a sufficient amount of the working fluid to the working gap especially when the viscosity is excessively high. Further, in the case of the method using a fixed abrasive grain wire saw, an increase of the water content of the known working fluid causes an increase of the coefficient of friction so that the fixed abrasive grains are apt to be detached.

In this circumstance, it is highly desired to provide a working fluid that has a high performance and can solve the environmental problem and problem of safety.

The present invention has been made under the above-described circumstances, and it is, therefore, an object of the present invention to provide a water-containing working fluid which, when used in a loose-abrasive grain method, allows a slurry thereof to be supplied into the working gap sufficiently and has excellent abrasive grain dispersion stability and excellent properties to wash and disperse cutting swarf, and to provide a water-containing working fluid which, when used in a method using a fixed-abrasive grain wire saw, rarely causes detachment of the fixed abrasive grains and has excellent properties to wash and disperse cutting swarf.

[Means for Solving the Problem]

[0008]

The present inventors have made an earnest study and, as a result, found that the above problems can be solved by a working fluid containing specific additives.

That is, the present invention provides:

1. A working fluid for hard and brittle materials comprising the following components (A) to (C):

(A) water,

(B) a water soluble polymeric compound having an oxygen-containing group and a number average molecular weight of 6,000 to 3,000,000, and

(C) a nonionic surfactant having a clouding point of 10 to 70°C in a 1% by mass aqueous solution;

2. The working fluid for hard and brittle materials as recited in above 1, wherein the oxygen-containing group of the component (B) is a group selected from a carboxyl group, a hydroxyl group, an oxyethylene group and an oxypropylene group;

3. The working fluid for hard and brittle materials as recited in above 1 or 2, wherein the component (B) is a carboxylic acid-based polymeric compound and/or an alkylene glycol-based polymeric compound;

4. The working fluid for hard and brittle materials as recited in above 3, wherein the component (B) is a combination of a carboxylic acid-based polymeric compound and an alkylene glycol-based polymeric compound;

5. The working fluid for hard and brittle materials as recited in any one of above 1 to 4, wherein the component (C) is a nonionic surfactant containing an oxypropylene group and having a number average molecular weight of 70 to 5,000;

6. The working fluid for hard and brittle materials as recited in any one of above 1 to 5, wherein the content of the component (A) is 50 to 99% by mass, the content of the component (B) is 0.01 to 30% by mass, and the content of the component (C) is 0.1 to 20% by mass, based on the total amount of the working fluid;

7. The working fluid for hard and brittle materials as recited in any one of above 1 to 6, wherein the working fluid has a pH of 2 to 10; and

8. The working fluid for hard and brittle materials as recited in above 7, wherein the working fluid contains an acid component and an alkaline component, and wherein the pH has been adjusted by controlling a blending ratio of the acid and alkaline components.

[Effect of the Invention]

[0009]

According to the present invention, it is possible to provide a water-containing working fluid which, when used in wire saw working by a loose abrasive grain method, allows a slurry thereof to be supplied into the working gap sufficiently and has excellent abrasive grain dispersion stability and excellent properties to wash (disperse) cutting swarf, and to provide a water-containing working fluid which, when used in a method using a fixed-abrasive grain wire saw, rarely causes detachment of the fixed abrasive grains and has excellent properties to wash (disperse) cutting swarf.

[Best Mode for Carrying out the Invention]

[0010]

A working fluid for hard materials and brittle materials (hereinafter occasionally referred to as "hard and brittle materials") of the present invention is a working fluid including (A) water, (B) a specific water soluble polymeric compound, and (C) a specific nonionic surfactant.

[0011]

Though water used as the component (A) of the working fluid for hard and brittle materials according to the present invention is not specifically limited, purified water,

As described above, a water-containing working fluid is known. When the water content of the known working fluid is increased, however, abrasive grains used in a loose abrasive grain method are apt to sediment so that it becomes difficult to evenly supply the abrasive grains in the working gap. Although the abrasive grains might be expected not to easily sediment by an increase of the viscosity of the working fluid, it becomes difficult to feed a sufficient amount of the working fluid to the working gap especially when the viscosity is excessively high. Further, in the case of the method using a fixed abrasive grain wire saw, an increase of the water content of the known working fluid causes an increase of the coefficient of friction so that the fixed abrasive grains are apt to be detached.

In this circumstance, it is highly desired to provide a working fluid that has a high performance and can solve the environmental problem and problem of safety.

The present invention has been made under the above-described circumstances, and it is, therefore, an object of the present invention to provide a water-containing working fluid which, when used in a loose-abrasive grain method, allows a slurry thereof to be supplied into the working gap sufficiently and has excellent abrasive grain dispersion stability and excellent properties to wash and disperse cutting swarf, and to provide a water-containing working fluid which, when used in a method using a fixed-abrasive grain wire saw, rarely causes detachment of the fixed abrasive grains and has excellent properties to wash and disperse cutting swarf.

[Means for Solving the Problem]

[0008]

The present inventors have made an earnest study and, as a result, found that the above problems can be solved by a working fluid containing specific additives.

That is, the present invention provides:

1. A working fluid for hard and brittle materials comprising the following components (A) to (C):

(A) water,

(B) a water soluble polymeric compound having an oxygen-containing group and a number average molecular weight of 6,000 to 3,000,000, and

(C) a nonionic surfactant having a clouding point of 10 to 70°C in a 1% by mass aqueous solution and wherein the component (C) is a nonionic surfactant containing an oxypropylene group and having a number average molecular weight of 70 to 5,000;

2. The working fluid for hard and brittle materials as recited in above 1, wherein the oxygen-containing group of the component (B) is a group selected from a carboxyl group, a hydroxyl group, an oxyethylene group and an oxypropylene group;

3. The working fluid for hard and brittle materials as recited in above 1 or 2, wherein the component (B) is a carboxylic acid-based polymeric compound and/or an alkylene glycolbased

polymeric compound;

4. The working fluid for hard and brittle materials as recited in above 3, wherein the component (B) is a combination of a carboxylic acid-based polymeric compound and an alkylene glycol-based polymeric compound;

5. The working fluid for hard and brittle materials as recited in anyone of above 1 to 4, wherein the content of the component (A) is 50 to 99% by mass, the content of the component (B) is 0.01 to 30% by mass, and the content of the component (C) is 0.1 to 20% by mass, based on the total amount of the working fluid;

6. The working fluid for hard and brittle materials as recited in anyone of above 1 to 5, wherein the working fluid has a pH of 2 to 10; and

7. The working fluid for hard and brittle materials as recited in above 6, wherein the working fluid contains an acid component and an alkaline component, and wherein the pH has been adjusted by controlling a blending ratio of the acid and alkaline components.

[Effect of the Invention]

[0009]

According to the present invention, it is possible to provide a water-containing working fluid which, when used in wire saw working by a loose abrasive grain method, allows a slurry thereof to be supplied into the working gap sufficiently and has excellent abrasive grain dispersion stability and excellent properties to wash (disperse) cutting swarf, and to provide a water-containing working fluid which, when used in a method using a fixed-abrasive grain wire saw, rarely causes detachment of the fixed abrasive grains and has excellent properties to wash (disperse) cutting swarf.

[Best Mode for Carrying out the Invention]

[0010]

A working fluid for hard materials and brittle materials (hereinafter occasionally referred to as "hard and brittle materials") of the present invention is a working fluid including (A) water, (B) a specific water soluble polymeric compound, and (C) a specific nonionic surfactant.

[0011]

Though water used as the component (A) of the working fluid for hard and brittle materials according to the present invention is not specifically limited, purified water,