Claims

1. A water-soluble metal-working oil agent, characterized by comprising including a component A, a component B, a component C, and a component D, wherein:

the component A is an ester compound which has a characteristic temperature, as measured in accordance with JIS K2242, of 570°C or higher and which is contained in the water-soluble metal-working oil agent in an amount of 10 mass% or more with respect to the entire amount of the agent;

the component B is at least one condensed fatty acid which is selected from a condensed fatty acid (1), produced through dehydration condensation of a hydroxycarboxylic acid, and a condensed fatty acid (2), produced through dehydration condensation of an alcoholic hydroxyl group of the condensed fatty acid (1) with a monovalent carboxylic acid, which has a characteristic temperature, as measured in accordance with JIS K2242, of 650°C or higher, and which is contained in the water-soluble metal-working oil agent in an amount of 7.5 mass% or more with respect to the entire amount of the agent;

the component C is a carboxylic acid which is contained in the water-soluble metal-working oil agent in an amount of 2 mass% or more with respect to the entire amount of the agent; and

the component D is a basic compound contained in such a neutralization equivalent that at least the component B and component C are neutralized to cancel out the sum of the acid

values thereof.

2. The A water-soluble metal-working oil according to claim 1, wherein the component A has a characteristic temperature of 650°C or higher.

3. The A water-soluble metal-working oil according to claim 1 or claim 2, wherein the component A is a polyol ester.

4. The water-soluble metal-working oil according to claim 3, wherein the polyol ester is an ester of an alcohol selected from the group consisting of pentaerythritol, neopentyl glycol, and trimethylolpropane with a carboxylic acid; and wherein the component B is the condensed fatty acid (1) or a combination of the condensed fatty acid (1) and the condensed fatty acid (2).

5. The A water-soluble metal-working oil according to claim 3, wherein the polyol ester is an ester of pentaerythritol with a carboxylic acid.

6. The A water-soluble metal-working oil according to any one of the preceding claims 1 to 4, wherein the component B has an acid value of 60 mgKOH/g or less and a hydroxyl value of 50 mgKOH/g or less.

7. The A water-soluble metal-working oil according to

any one of the preceding claims 1 to 5, wherein the component D is an amine compound or an alkali metal compound.

8. The A water-soluble metal-working oil according to claim 7, wherein the amine compound is at least one of an alkanolamine and an alkylamine.

9. The A water-soluble metal-working oil according to any one of the preceding claims 1 to 7, which further contains water.

10. A metal-working liquid comprising a water-soluble metal-working oil agent as recited in any one of the preceding claims 1 to 8, the agent being diluted by water.

11. A metal-working method comprising working a metal workpiece by use of a water-soluble metal-working oil agent as recited in according to any one of claims 1 to 9.

12. The A metal-working method comprising working a metal workpiece by use of a metal-working liquid as recited in according to claim 10.

13. The A metal-working method according to claim 11 or claim 12, wherein the workpiece is at least one species selected from the group consisting of titanium, titanium alloy, nickel alloy, niobium alloy, tantalum alloy,

molybdenum alloy, tungsten alloy, stainless steel, and high-manganese steel.

14. The A metal-working method according to any one of claims 11 to 13, which is intermittent cutting.

Claims

1. A water-soluble metal-working oil agent, characterized by comprising a component A, a component B, a component C, and a component D, wherein:

the component A is an ester compound which has a characteristic temperature, as measured in accordance with JIS K2242, of 270°C or higher and which is contained in the water-soluble metal-working oil agent in an amount of 10 mass% or more with respect to the entire amount of the agent;

the component B is at least one condensed fatty acid which is selected from a condensed fatty acid (1), produced through dehydration condensation of a hydroxycarboxylic acid, and a condensed fatty acid (2), produced through dehydration condensation of an alcoholic hydroxyl group of the condensed fatty acid (1) with a monovalent carboxylic acid, which has a characteristic temperature, as measured in accordance with JIS K2242, of 650°C or higher, and which is contained in the water-soluble metal-working oil agent in an amount of 7.5 mass% or more with respect to the entire amount of the agent;

the component C is a carboxylic acid which is contained in the water-soluble metal-working oil agent in an amount of 2 mass% or more with respect to the entire amount of the agent; and

the component D is a basic compound contained in such a neutralization equivalent that at least the component B and component C are neutralized to cancel out the sum of the acid

values thereof.

2. A water-soluble metal-working oil according to claim 1, wherein the component A has a characteristic temperature of 650°C or higher.

3. A water-soluble metal-working oil according to claim 1 or 2, wherein the component A is a polyol ester.

4. A water-soluble metal-working oil according to claim 3, wherein the polyol ester is an ester of pentaerythritol with a carboxylic acid.

5. A water-soluble metal-working oil according to any of claims 1 to 4, wherein the component B has an acid value of 60 mgKOH/g or less and a hydroxyl value of 50 mgKOH/g or less.

6. A water-soluble metal-working oil according to any of claims 1 to 5, wherein the component D is an amine compound or an alkali metal compound.

7. A water-soluble metal-working oil according to claim 6, wherein the amine compound is at least one of an alkanolamine and an alkylamine.

8. A water-soluble metal-working oil according to any of claims 1 to 7, which further contains water.

9. A metal-working liquid comprising a water-soluble metal-working oil agent as recited in any of claims 1 to 8, the agent being diluted by water.

10. A metal-working method comprising working a metal workpiece by use of a water-soluble metal-working oil agent as recited in any of claims 1 to 8.

11. A metal-working method comprising working a metal workpiece by use of a metal-working liquid as recited in claim 9.

12. A metal-working method according to claim 10 or 11, wherein the workpiece is at least one species selected from the group consisting of titanium, titanium alloy, nickel alloy, niobium alloy, tantalum alloy, molybdenum alloy, tungsten alloy, stainless steel, and high-manganese steel.

13. A metal-working method according to any of claims 10 to 12, which is intermittent cutting.