CLAIMS

1. A photoresist stripping solution for repeated used in stripping a photoresist formed on a copper film, the photoresist stripping solution comprising:

1% to 9% by mass of a tertiary alkanolamine~~,~~;

10% to 70% by mass of a polar solvent~~,~~;

10% to 40% by mass of water~~,~~; and

500 ppm to 3000 ppm ~~or less~~ of a resist composition;

wherein the polar solvent is a mixed solvent of diethylene glycol monobutyl ether and propylene glycol; and

the resist composition is originated from an exposed positive photoresist.

2. The photoresist stripping solution according to claim 1, wherein the tertiary alkanolamine is N-methyldiethanolamine (MDEA).

~~3. The photoresist stripping solution according to claim 2, wherein the resist composition is originated from an exposed positive photoresist.~~

~~4. The photoresist stripping solution according to claim 2, wherein the polar solvent is a mixed solvent of diethylene glycol monobutyl ether and propylene glycol.~~

~~5. The photoresist stripping solution according to claim 4, wherein the resist composition is originated from an exposed positive photoresist.~~

~~6. The photoresist stripping solution according to claim 1, wherein the polar solvent is a mixed solvent of diethylene glycol monobutyl ether and propylene glycol.~~

~~7. The photoresist stripping solution according to claim 6, wherein the resist composition is originated from an exposed positive photoresist.~~

~~8. The photoresist stripping solution according to claim 1, wherein the resist composition is originated from an exposed positive photoresist.~~

~~9~~3. The photoresist stripping solution according to any one of claims 1 to ~~8~~2, wherein the stripping solution is one for stripping a positive photoresist coated on ~~a~~ the ~~Cu~~ copper film.

~~10~~4. A method for recycling a photoresist stripping solution, the photoresist stripping solution comprising 1% to 9% by mass of a tertiary alkanolamine, 10% to 70% by mass of a

polar solvent, 10% to 40% by mass of water, and 3000 ppm or less of a resist composition originated from an exposed positive photoresist, the method comprising the steps of:

introducing the stripping solution into a process vessel where a stripping process is conducted;

conducting the stripping process;

monitoring a resist concentration in a stripping process solution;

stopping the stripping process when a concentration of the resist composition in the stripping solution exceeds a given value, and withdrawing part of the stripping solution;

extracting a separated liquid containing the tertiary alkanolamine and the polar solvent by distilling the withdrawn stripping solution;

regenerating the stripping solution by adding components deficient as the stripping solution to the separated liquid; and

introducing the regenerated stripping solution into the process vessel again.

~~11~~5. A stripping solution recycling system that regenerates and uses a stripping solution for stripping an exposed positive resist film which is formed on a Cu film, the stripping solution recycling system comprising:

a stripping solution tank for storing therein a stripping

solution comprising a resist composition originated from an exposed positive photoresist and a mixed solution comprising a main agent, a polar solvent, and water;

removing means for removing an exposed positive resist film on a workpiece repeatedly using the stripping solution in the stripping solution tank;

a supply tube for supplying the mixed solution to the stripping solution tank;

a discharge tube for discharging part of the stripping solution in the stripping solution tank;

a resist stripping device for discharging part of the stripping solution from the discharge tube when a resist concentration of the stripping solution reaches a given value and receiving supply of a fresh stripping solution from the supply tube;

a waste tank for storing therein the discharged stripping solution, the waste tank being connected to the discharge tube;

a distillation and regeneration device for distilling the discharged stripping solution in the waste tank to obtain a separated liquid containing the main agent and the polar solvent;

a component analyzer for investigating a composition ratio of the main agent and the polar solvent in the separated liquid;

a preparation device for preparing a regenerated mixed solution by adding deficiencies of the main agent, the polar solvent, and water to show a predetermined proportion of the main agent, the polar solvent, and the water in the separated liquid; and

a supply tank for storing therein the regenerated mixed solution.

~~12~~6. The stripping solution recycling system according to claim ~~11~~5, wherein the stripping solution includes 1% to 9% by mass of a tertiary alkanolamine, 10% to 70% by mass of a polar solvent, 10% to 40% by mass of water, and 100 ppm to 3000 ppm of the resist composition.

~~13~~7. The stripping solution recycling system according to claim ~~12~~5 or 6, wherein the stripping solution and the workpiece are processed at the same temperature ranging from 35°C to 45°C in the removing means.

~~14~~8. The stripping solution recycling system according to claim ~~13~~6 or 7, wherein the tertiary alkanolamine is Nmethyldiethanolamine(MDEA).

~~15~~9. The stripping solution recycling system according to any one of claims ~~14~~6 to 8, wherein the polar solvent is a

mixed solvent of diethylene glycol monobutyl ether and propylene glycol.

~~16. The stripping solution recycling system according to claim 14, wherein the resist composition is originated from an exposed positive photoresist.~~

~~17~~10. The stripping solution recycling system according to any one of claims ~~14~~5 to 9, comprising a substrate washing line including:

a washing tank for storing the mixed solution supplied through a branch tube branched from the supply line;

a pump for pumping up the mixed solution from the washing tank;

a shower for allowing the mixed solution pumped up by the pump to fall down; and

transfer means for transferring a substrate below the shower.

~~18. The stripping solution recycling system according to claim 15, wherein the resist composition is originated from an exposed positive photoresist.~~

~~19. The stripping solution recycling system according to claim 15, comprising a substrate washing line including:~~

~~a washing tank for storing the mixed solution supplied through a branch tube branched from the supply line;~~

~~a pump for pumping up the mixed solution from the washing tank;~~

~~a shower for allowing the mixed solution pumped up by the pump to fall down; and~~

~~transfer means for transferring a substrate below the shower.~~

~~20. The stripping solution recycling system according to claim 18, comprising a substrate washing line including:~~

~~a washing tank for storing the mixed solution supplied through a branch tube branched from the supply line;~~

~~a pump for pumping up the mixed solution from the washing tank;~~

~~a shower for allowing the mixed solution pumped up by the pump to fall down; and~~

~~transfer means for transferring a substrate below the shower.~~

~~21. The stripping solution recycling system according to claim 13, wherein the polar solvent is a mixed solvent of diethylene glycol monobutyl ether and propylene glycol.~~

~~22. The stripping solution recycling system according to~~

~~claim 13, wherein the resist composition is originated from an exposed positive photoresist.~~

~~23. The stripping solution recycling system according to claim 13, comprising a substrate washing line including:~~

~~a washing tank for storing the mixed solution supplied through a branch tube branched from the supply line;~~

~~a pump for pumping up the mixed solution from the washing tank;~~

~~a shower for allowing the mixed solution pumped up by the pump to fall down; and~~

~~transfer means for transferring a substrate below the shower.~~

~~24. The stripping solution recycling system according to claim 12, wherein the tertiary alkanolamine is N-methyldiethanolamine (MDEA).~~

~~25. The stripping solution recycling system according to claim 12, wherein the polar solvent is a mixed solvent of diethylene glycol monobutyl ether and propylene glycol.~~

~~26. The stripping solution recycling system according to claim 12, wherein the resist composition is originated from an exposed positive photoresist.~~

~~27. The stripping solution recycling system according to claim 12, comprising a substrate washing line including:~~

~~a washing tank for storing the mixed solution supplied through a branch tube branched from the supply line;~~

~~a pump for pumping up the mixed solution from the washing tank;~~

~~a shower for allowing the mixed solution pumped up by the pump to fall down; and~~

~~transfer means for transferring a substrate below the shower.~~

~~28. The stripping solution recycling system according to claim 11, wherein the stripping solution and the workpiece are processed at the same temperature ranging from 35°C to 45°C in the removing means.~~

~~29. The stripping solution recycling system according to claim 28, wherein the tertiary alkanolamine is Nmethyldiethanolamine (MDEA).~~

~~30. The stripping solution recycling system according to claim 29, wherein the polar solvent is a mixed solvent of diethylene glycol monobutyl ether and propylene glycol.~~

~~31. The stripping solution recycling system according to claim 29, wherein the resist composition is originated from an exposed positive photoresist.~~

~~32. The stripping solution recycling system according to claim 29, comprising a substrate washing line including:~~

~~a washing tank for storing the mixed solution supplied through a branch tube branched from the supply line;~~

~~a pump for pumping up the mixed solution from the washing tank;~~

~~a shower for allowing the mixed solution pumped up by the pump to fall down; and~~

~~transfer means for transferring a substrate below the shower.~~

~~33. The stripping solution recycling system according to claim 30, wherein the resist composition is originated from an exposed positive photoresist.~~

~~34. The stripping solution recycling system according to claim 30, comprising a substrate washing line including:~~

~~a washing tank for storing the mixed solution supplied through a branch tube branched from the supply line;~~

~~a pump for pumping up the mixed solution from the washing tank;~~

~~a shower for allowing the mixed solution pumped up by the pump to fall down; and~~

~~transfer means for transferring a substrate below the shower.~~

~~35. The stripping solution recycling system according to claim 33, comprising a substrate washing line including:~~

~~a washing tank for storing the mixed solution supplied through a branch tube branched from the supply line;~~

~~a pump for pumping up the mixed solution from the washing tank;~~

~~a shower for allowing the mixed solution pumped up by the pump to fall down; and~~

~~transfer means for transferring a substrate below the shower.~~

~~36. The stripping solution recycling system according to claim 28, wherein the polar solvent is a mixed solvent of diethylene glycol monobutyl ether and propylene glycol.~~

~~37. The stripping solution recycling system according to claim 28, wherein the resist composition is originated from an exposed positive photoresist.~~

~~38. The stripping solution recycling system according to~~

~~claim 28, comprising a substrate washing line including:~~

~~a washing tank for storing the mixed solution supplied through a branch tube branched from the supply line;~~

~~a pump for pumping up the mixed solution from the washing tank;~~

~~a shower for allowing the mixed solution pumped up by the pump to fall down; and~~

~~transfer means for transferring a substrate below the shower.~~

~~39. The stripping solution recycling system according to claim 11, comprising a substrate washing line including:~~

~~a washing tank for storing the mixed solution supplied through a branch tube branched from the supply line;~~

~~a pump for pumping up the mixed solution from the washing tank;~~

~~a shower for allowing the mixed solution pumped up by the pump to fall down; and~~

~~transfer means for transferring a substrate below the shower.~~

~~40~~11. A method for operating the stripping solution recycling system according to any one of claims ~~11~~ 5 to ~~39~~10, the method comprising the steps of:

determining a resist concentration of a stripping

solution in the stripping solution tank of the resist stripping device;

withdrawing part of the storage stripping solution when the resist concentration reaches a given value;

adding a mixed solution to the stripping solution tank from the supply tank until the resist concentration reaches a given minimum value;

~~Obtaining~~ obtaining a separated liquid containing the main agent and the polar solvent by distilling the withdrawn part of the stripping solution in the distillation and regeneration device;

investigating a component ratio in the separated liquid;

preparing a regenerated mixed solution by adding deficiencies of the main agent, the polar solvent, and water to show a predetermined proportion of the main agent, the polar solvent, and the water in the separated liquid; and

storing the regenerated mixed solution in the supply tank.