evaluation results concerning the etch rate of each metal film were not shown in the tables.

[0070]

[Table 1]

	HYDROFLUORIC ACID (WEIGHT %)	AMMONIUM FLUORIDE (WEIGHT %)	ORGANIC ACID		ADDITIVE		SURFACTANT		WATER (WEIGHT %)
			TYPE	CONTENT (WEIGHT %)	TYPE	CONTENT (WEIGHT %)	TYPE	CONTENT (WEIGHT %)	
EXAMPLE 1	2.5	20	ACETIC ACID	35	1,4-BD	10	-	0	32.5
EXAMPLE 2	1.5	20	ACETIC ACID	35	1,4-BD	10	-	0	33.5
EXAMPLE 3	4.5	20	ACETIC ACID	35	1,4-BD	10	-	0	30.5
EXAMPLE 4	10	15	ACETIC ACID	35	1,4-BD	10	-	0	30
EXAMPLE 5	1.5	25	ACETIC ACID	35	1,4-BD	10	-	0	28.5
EXAMPLE 6	2.5	10	ACETIC ACID	60	1,4-BD	10	-	0	17.5
EXAMPLE 7	2.5	20	ACETIC ACID	35	1,4-BD	5	-	0	37.5
EXAMPLE 8	2.5	15	ACETIC ACID	15	1,4-BD	40	-	0	27.5
EXAMPLE 9	3.5	20	LACTIC ACID	31.1	1,4-BD	7.6	-	0	37.8
EXAMPLE 10	1.5	15	LACTIC ACID	45.8	1,4-BD	7.6	-	0	30.1
EXAMPLE 11	1.5	15	ACETIC ACID	44.2	1,4-BD	7.6	-	0	24.1
			MSA	7.6					
EXAMPLE 12	3.5	20	ACETIC ACID	35	1,6-HD	7.6	-	0	33.9

[0071]

[Table 2]

	HYDROFLUORIC ACID (WEIGHT %)	AMMONIUM FLUORIDE (WEIGHT %)	ORGANIC ACID		ADDITIVE		SURFACTANT		WATER (WEIGHT %)
			TYPE	CONTENT (WEIGHT %)	TYPE	CONTENT (WEIGHT %)	TYPE	CONTENT (WEIGHT %)	
EXAMPLE 13	1.5	15	ACETIC ACID	51.8	1,6-HD	7.6	-	0	24.1
EXAMPLE 14	3.5	20	ACETIC ACID	35	1,3-CHD	7.6	-	0	33.9
EXAMPLE 15	3.5	20	LACTIC ACID	31.1	3-MP-1,3,5-TO	7.6	-	0	37.8
EXAMPLE 16	1.5	15	ACETIC ACID	51.8	FFA	7.6	-	0	24.1
EXAMPLE 17	1.5	15	ACETIC ACID	51.8	PG	7.6	-	0	24.1
EXAMPLE 18	3.5	20	ACETIC ACID	35	PEG	7.6	-	0	33.9
EXAMPLE 19	3.5	20	ACETIC ACID	35	CYCLOPENTANONE	7.6	-	0	33.9
EXAMPLE 20	1.5	15	ACETIC ACID	51.8	SULFAMIC ACID	7.6	-	0	24.1
EXAMPLE 21	1.5	15	LACTIC ACID	45.8	AMMONIUM NITRATE	7.6	-	0	30.1
EXAMPLE 22	3.5	20	ACETIC ACID	35	1,4-BD	7.6	F SERIES-1	0.01	33.89
EXAMPLE 23	3.5	20	ACETIC ACID	35	1,4-BD	7.6	F SERIES-2	0.001	33.899
EXAMPLE 24	3.5	20	ACETIC ACID	35	1,4-BD	7.6	F SERIES-3	0.001	33.899

[0072]

[Table 3]

	HYDROFLUORIC ACID (WEIGHT %)	AMMONIUM FLUORIDE (WEIGHT %)	ORGANIC ACID		ADDITIVE		SURFACTANT		WATER (WEIGHT %)
			TYPE	CONTENT (WEIGHT %)	TYPE	CONTENT (WEIGHT %)	TYPE	CONTENT (WEIGHT %)	
COMPARATIVE EXAMPLE 1	6	30	-	0	-	0	-	0	64
COMPARATIVE EXAMPLE 2	1.5	15	-	0	-	0	-	0	83.5
COMPARATIVE EXAMPLE 3	3.5	20	ACETIC ACID	42.7	-	0	-	0	33.8
COMPARATIVE EXAMPLE 4	3.5	20	LACTIC ACID	36.9	-	0	-	0	39.6
COMPARATIVE EXAMPLE 5	1.5	15	ACETIC ACID	59.3	-	0	-	0	24.2
COMPARATIVE EXAMPLE 6	3.5	20	-	0	PG	42.7	-	0	33.8
COMPARATIVE EXAMPLE 7	1.5	15	-	0	1,4-BD	24.4	-	0	59.1

[0073]

[Table 4]

	ETCH RATE (Å/MINUTE)			Al				AlCu				REMOVABILITY OF NATURAL OXIDE FILM	RESIST DAMAGE
				ETCHED AMOUNT(Å)	SELECTIVITY RATIO			ETCHED AMOUNT(Å)	SELECTIVITY RATIO				
	th-SiO_2	P-TEOS	P-SIN	ONE-MINUTE ETCHING	th-SiO_2	P-TEOS	P-SIN	ONE-MINUTE ETCHING	th-SiO_2	P-TEOS	P-SIN		
EXAMPLE 1	762	1868	119	77	9.9	24.5	1.5	125	6.1	15.1	1.0	GOOD	POOR
EXAMPLE 2	631	1500	100	55	11.5	27.3	1.8	100	6.3	15.0	1.0	GOOD	POOR
EXAMPLE 3	1084	2610	161	93	11.7	28.1	1.7	130	8.3	20.1	1.2	GOOD	POOR
EXAMPLE 4	2380	5118	322	113	21.1	45.3	2.8	169	14.1	30.3	1.9	GOOD	POOR
EXAMPLE 5	729	1626	104	88	8.3	18.5	1.2	108	6.8	15.1	1.0	GOOD	POOR
EXAMPLE 6	794	2397	147	84	9.5	28.5	1.8	120	6.6	20.0	1.2	GOOD	POOR
EXAMPLE 7	811	1949	127	68	11.9	28.7	1.9	134	6.1	14.5	0.9	GOOD	POOR
EXAMPLE 8	685	1519	104	61	11.2	24.9	1.7	108	6.3	14.1	1.0	GOOD	POOR
EXAMPLE 9	1176	2743	185	94	12.5	29.2	2.0	204	5.8	13.4	0.9	GOOD	GOOD
EXAMPLE 10	831	2350	138	97	8.6	24.2	1.4	101	8.2	23.3	1.4	GOOD	GOOD
EXAMPLE 11	1029	2477	146	102	10.1	24.3	1.4	114	9.0	21.7	1.3	GOOD	POOR
EXAMPLE 12	1008	2393	144	86	11.7	27.8	1.7	147	6.9	16.3	1.0	GOOD	POOR

[0074]

[Table 5]

	ETCH RATE (Å/MINUTE)			Al				AlCu				REMOVABILITY OF NATURAL OXIDE FILM	RESIST DAMAGE
				ETCHED AMOUNT(Å)	SELECTIVITY RATIO			ETCHED AMOUNT(Å)	SELECTIVITY RATIO				
	th-SiO_2	P-TEOS	P-SiN	ONE-MINUTE ETCHING	th-SiO_2	P-TEOS	P-SiN	ONE-MINUTE ETCHING	th-SiO_2	P-TEOS	P-SiN		
EXAMPLE 13	769	2161	112	59	13.0	36.6	1.9	84	9.2	25.7	1.3	GOOD	POOR
EXAMPLE 14	984	2495	141	85	11.6	29.4	1.7	126	7.8	19.8	1.1	GOOD	POOR
EXAMPLE 15	986	2262	140	107	9.2	21.1	1.3	123	8.0	18.4	1.1	GOOD	GOOD
EXAMPLE 16	786	1978	120	103	7.6	19.2	1.2	133	5.9	14.9	0.9	GOOD	POOR
EXAMPLE 17	686	1437	94	75	9.1	19.2	1.3	86	8.0	16.7	1.1	GOOD	POOR
EXAMPLE 18	969	2228	130	94	10.3	23.7	1.4	133	7.3	16.8	1.0	GOOD	POOR
EXAMPLE 19	1001	2376	148	118	8.5	20.1	1.3	162	6.2	14.7	0.9	GOOD	POOR
EXAMPLE 20	1068	2529	157	103	10.4	24.6	1.5	132	8.1	19.2	1.2	GOOD	POOR
EXAMPLE 21	767	2158	143	86	8.9	25.1	1.7	130	5.9	16.6	1.1	GOOD	GOOD
EXAMPLE 22	1029	2473	145	118	8.7	21.0	1.2	170	6.1	14.5	0.9	GOOD	POOR
EXAMPLE 23	990	2357	139	91	10.9	25.9	1.5	159	6.2	14.8	0.9	GOOD	POOR
EXAMPLE 24	1011	2351	143	104	9.7	22.6	1.4	168	6.0	14.0	0.9	GOOD	POOR

[0075]

[Table 6]

	ETCH RATE (Å/MINUTE)			Al				AlCu				REMOVABILITY OF NATURAL OXIDE FILM	RESIST DAMAGE
				ETCHED AMOUNT (Å)	SELECTIVITY RATIO			ETCHED AMOUNT (Å)	SELECTIVITY RATIO				
	th-SiO_2	P-TEOS	P-SIN	ONE-MINUTE ETCHING	th-SiO_2	P-TEOS	P-SIN	ONE-MINUTE ETCHING	th-SiO_2	P-TEOS	P-SIN		
COMPARATIVE EXAMPLE 1	1111	2598	164	299	3.7	8.7	0.5	1494	0.7	1.7	0.1	GOOD	GOOD
COMPARATIVE EXAMPLE 2	333	883	84	848	0.4	1.0	0.1	1747	0.2	0.5	0.0	POOR	GOOD
COMPARATIVE EXAMPLE 3	1044	2361	150	194	5.4	12.2	0.8	291	3.6	8.1	0.5	GOOD	POOR
COMPARATIVE EXAMPLE 4	1187	2448	173	191	6.2	12.8	0.9	340	3.5	7.2	0.5	GOOD	GOOD
COMPARATIVE EXAMPLE 5	783	1887	126	134	5.8	14.1	0.9	157	4.7	11.3	0.8	GOOD	POOR
COMPARATIVE EXAMPLE 6	388	811	72	155	2.2	5.2	0.5	269	1.3	3.0	0.3	POOR	GOOD
COMPARATIVE EXAMPLE 7	294	685	65	216	1.4	3.2	0.3	423	0.7	1.6	0.1	POOR	GOOD

[0076]

The etching solutions of Comparative Example 1 and Comparative Example 2 are a kind of generally-used buffered hydrofluoric acid, which includes hydrofluoric acid, ammonium fluoride and water. The etching solutions of Comparative Examples 3, 4 and 5 are buffered hydrofluoric acid with only organic acid added, which includes hydrofluoric acid, ammonium fluoride, organic acid and water. The etching solutions of Comparative Examples 6 and 7 are buffered hydrofluoric acid with only alcohol added, which includes hydrofluoric acid, ammonium fluoride, alcohol and water.

[0077]

Referring to Tables 1 to 6, the etch rate of the silicon oxide film or silicon nitride film will be described below. Among Examples 1 to 24, Example 2 exhibits the lowest etch rate of 631 (Å/minute) for the thermally-oxidized film (th-SiO_2). The other solutions of Examples 1 to 24

CLAIMS

[Claim 1]

An etchant composition used to etch a silicon-containing film formed on a target substrate comprising:

at least one additive selected from the group consisting of an organic compound containing a hydroxyl group, an organic compound containing a carbonyl group, an inorganic acid and inorganic salt, hydrofluoric acid, ammonium fluoride, and an organic acid; wherein the etchant composition has a property to prevent corrosion of aluminum films and aluminum alloy films; wherein the organic acid is lactic acid, and the etchant composition has a property to prevent corrosion of a resist.

[Claim 2]

An etchant composition used to etch a silicon-containing film formed on a target substrate comprising:

at least one additive selected from the group consisting of an organic compound containing a hydroxyl group, an organic compound containing a carbonyl group, an inorganic acid and inorganic salt, hydrofluoric acid, ammonium fluoride, and an organic acid;

wherein the etchant composition has a property to prevent corrosion of aluminum films and aluminum alloy films;

wherein a concentration of hydrofluoric acid in the entire etching solution ranges from 0.5 weight % to 15 weight %, a concentration of ammonium fluoride in the entire etching solution ranges from 5 weight % to 30 weight %, a concentration of organic acid in the entire etching solution ranges from 5 weight % to 70 weight %, a concentration of additives in the entire etching solution ranges from 1 weight % to 70 weight %.

[Claim ~~3~~2]

The etchant composition according to claim 1 or 2 further comprising a surfactant.

[Claim ~~4~~3]

The etchant composition according to any one of claims 1 ~~or 2~~ to 3, wherein

the organic acid includes at least one additive selected from the group consisting of monocarboxylic acid, polycarboxylic acid, oxycarboxylic acid, phosphonic acid and sulfonic acid.

[Claim 45]

The etchant composition according to any of claims 1 to 34, wherein the organic acid includes at least one selected from the group consisting of acetic acid, propionic acid, oxalic acid, malonic acid, succinic acid, glutaric acid, glycolic acid, lactic acid, malic acid, tartaric acid, citric acid, amino tris (methylenephosphonic acid), 1-hydroxyethylidene-1,1-diphosphonic acid, methanesulfonic acid and ethanesulfonic acid.

[Claim 56]

The etchant composition according to any of claims 1 to 45, wherein the organic compound containing a hydroxyl group includes at least one additive selected from the group consisting of alcohols, glycols, triols and methylols.

[Claim 67]

The etchant composition according to any of claims 1 to 56, wherein the organic compound containing a hydroxyl group includes at least one additive selected from the group consisting of furfuryl alcohol, propylene glycol, polyethylene glycol, 1,4-butanediol, 3-methyl-1,3-butanediol, 1,6-hexanediol,

1,8-octanediol, 1,3-cyclohexanediol, 1,4-cyclohexanediol, 1,2,4-butanetriol, 3-methylpentane-1,3,5-triol and 1,4-cyclohexanedimethanol.

[Claim ~~7~~8]

The etchant composition according to any of claims 1 to ~~6~~7, wherein the organic compound containing a carbonyl group includes at least one additive selected from the group consisting of ketones, aldehydes and esters.

[Claim ~~8~~9]

The etchant composition according to any of claims 1 to ~~7~~8, wherein the organic compound containing a carbonyl group includes at least one additive selected from the group consisting of cyclopentanone and cyclohexanone.

[Claim ~~9~~10]

The etchant composition according to any of claims 1 to ~~8~~9, wherein the inorganic acid includes at least one additive selected from the group consisting of nitric acid, sulfuric acid and sulfamic acid.

[Claim ~~10~~11]

The etchant composition according to any of claims 1 to ~~9~~10, wherein the inorganic salt includes at least one selected from the group consisting of ammonium nitrate, ammonium sulfate and ammonium sulfamate.

[Claim ~~11~~12]

The etchant composition according ~~to any of~~ claim~~s~~ ~~3~~2 ~~to 10~~, wherein the surfactant includes at least one selected from the group consisting of an amphoteric surfactant, an anionic surfactant and a nonionic surfactant.

[Claim ~~12~~13]

An etching method ~~used to etch a silicon-containing film formed on a target substrate, the etching method~~ comprising:

applying the etchant composition of any one of claims 1 to 12.~~etching with an etchant composition including at least one selected from the group consisting of an organic compound containing a hydroxyl group, an organic compound containing a carbonyl group, an inorganic acid and inorganic salt, hydrofluoric acid, ammonium fluoride and an organic acid.~~