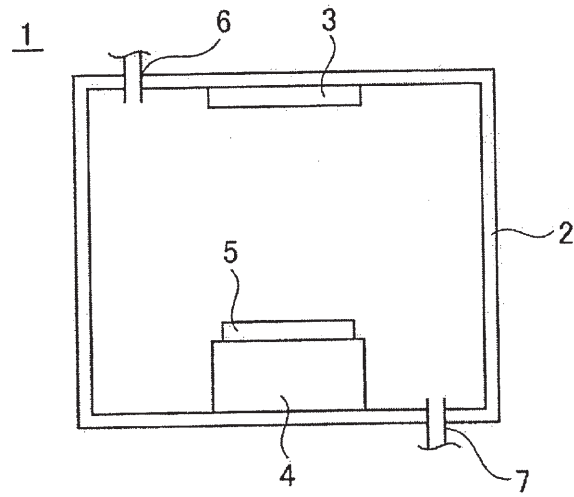


FIG. 1

(a)



(b)

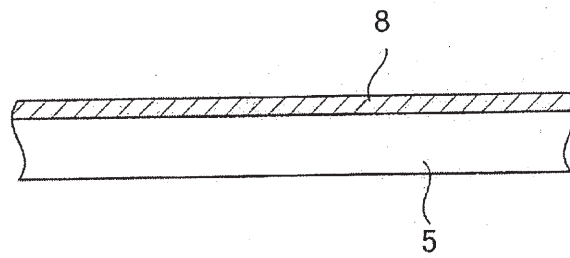


FIG.2

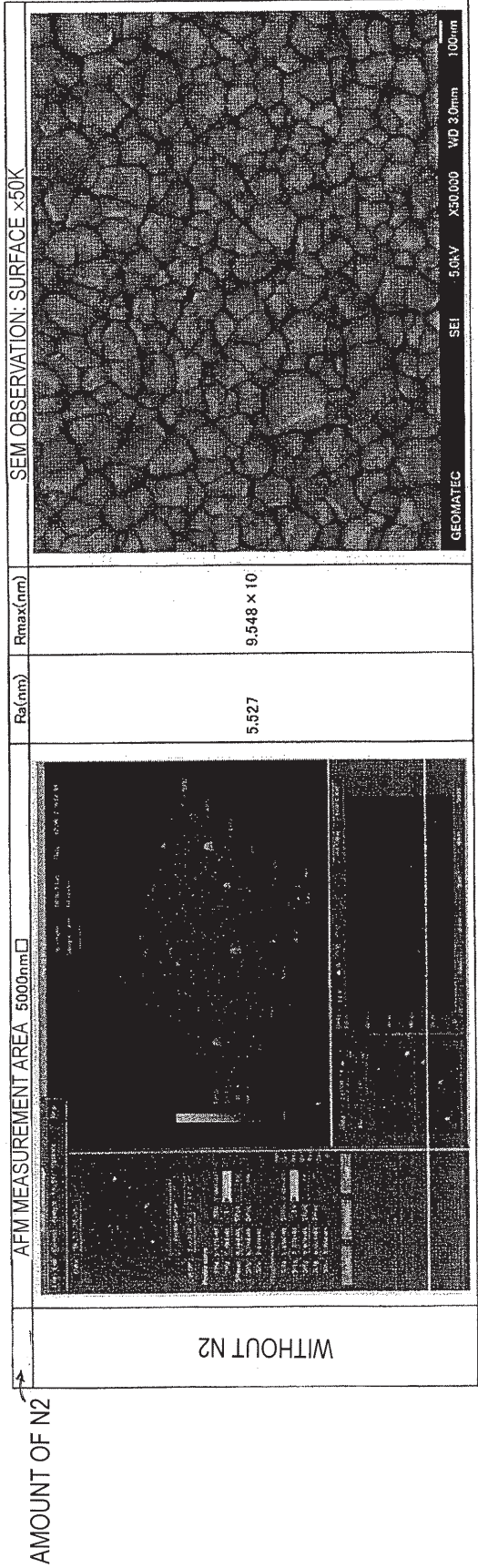


FIG.3

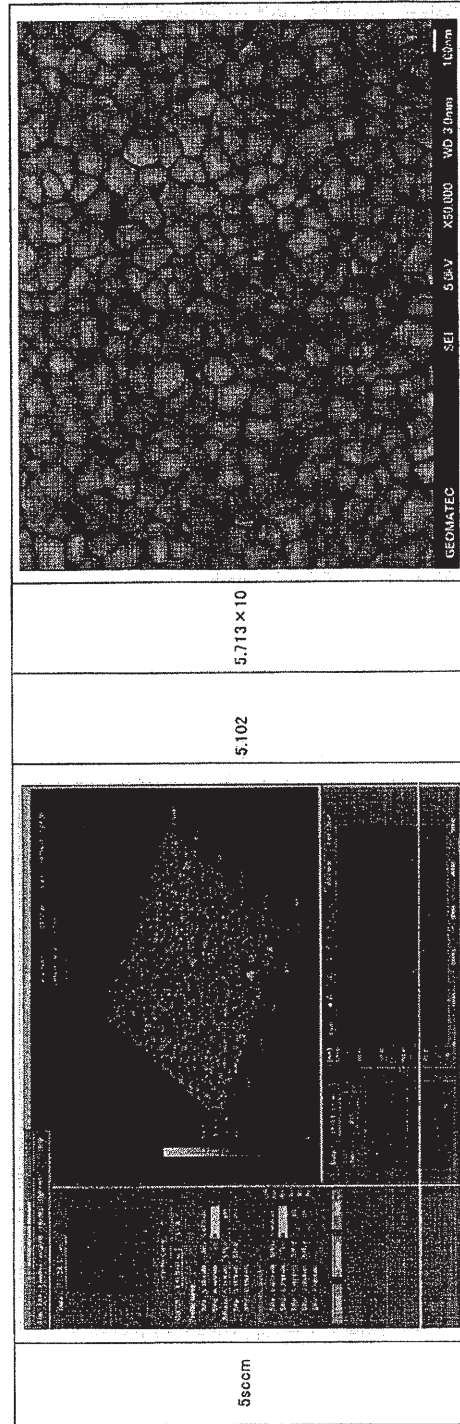


FIG. 4

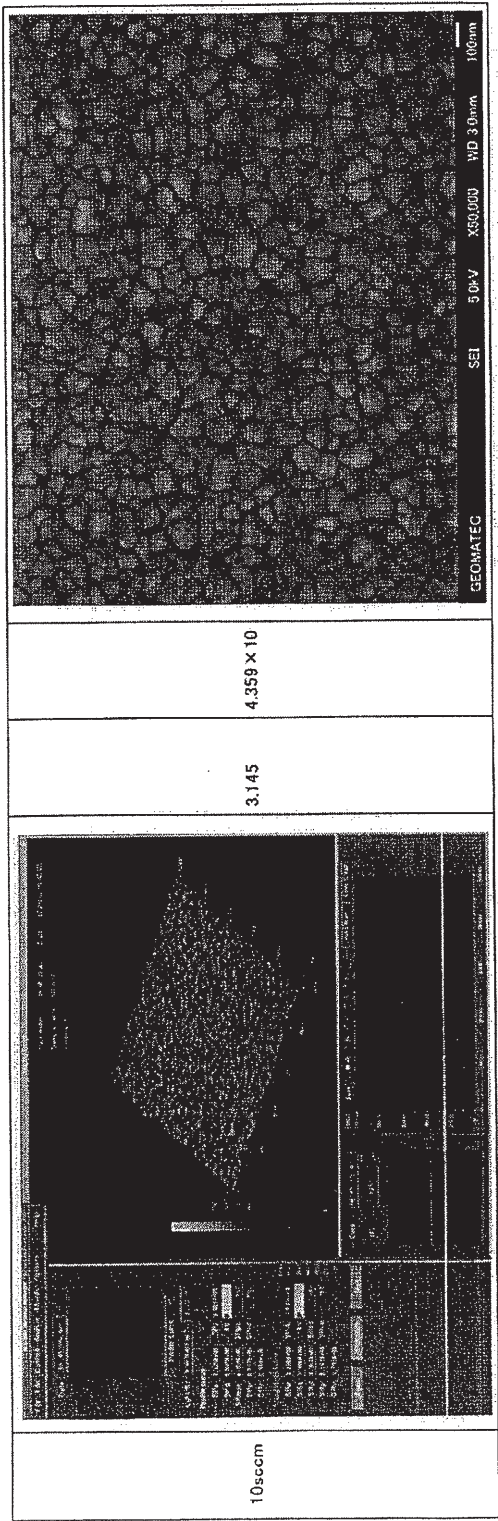


FIG. 5

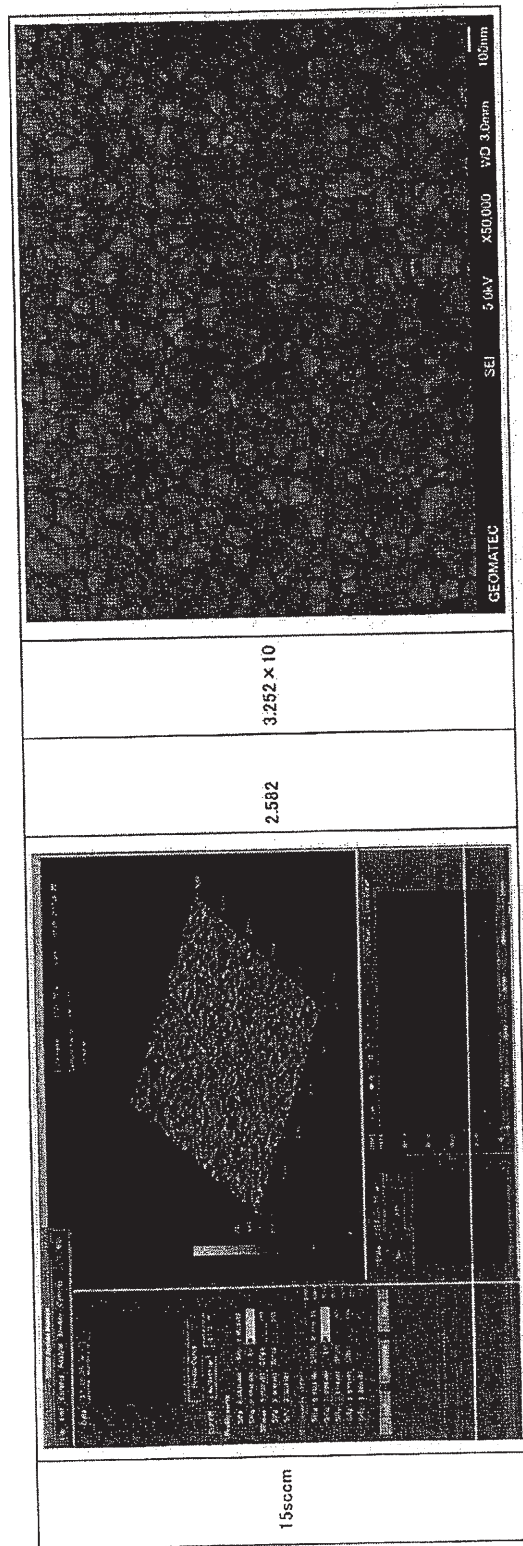


FIG. 6

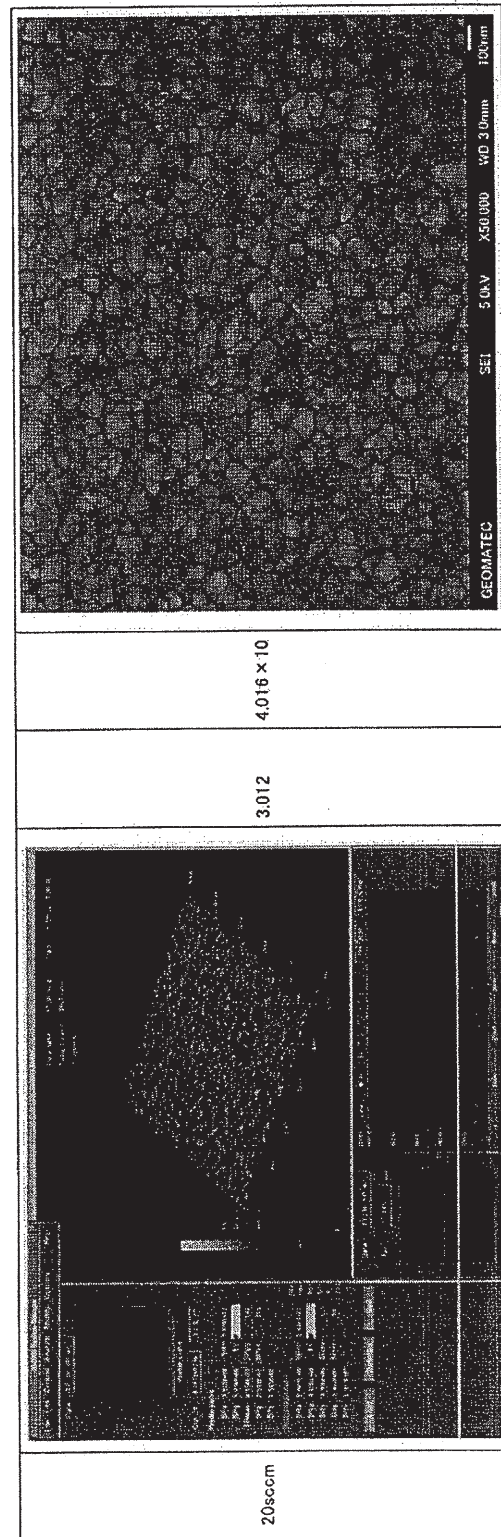
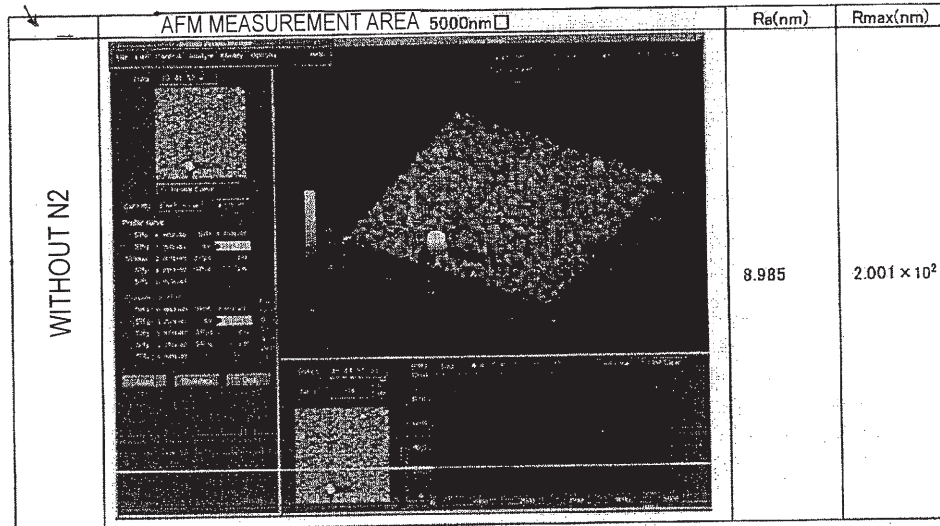


FIG. 7

(a)

AMOUNT OF N₂

(b)

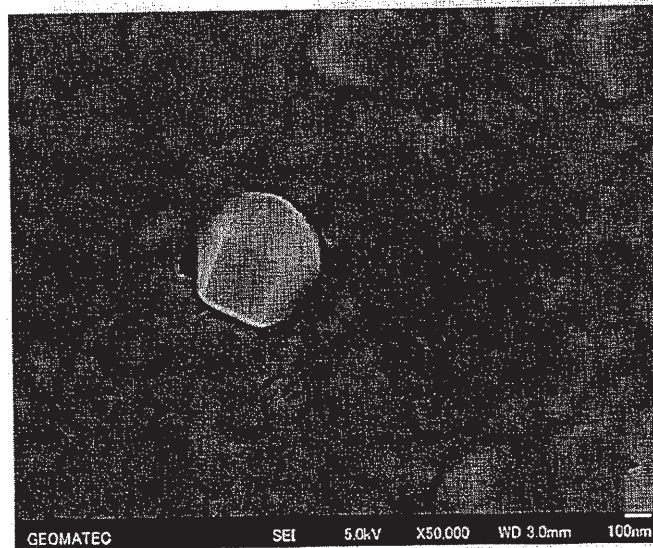
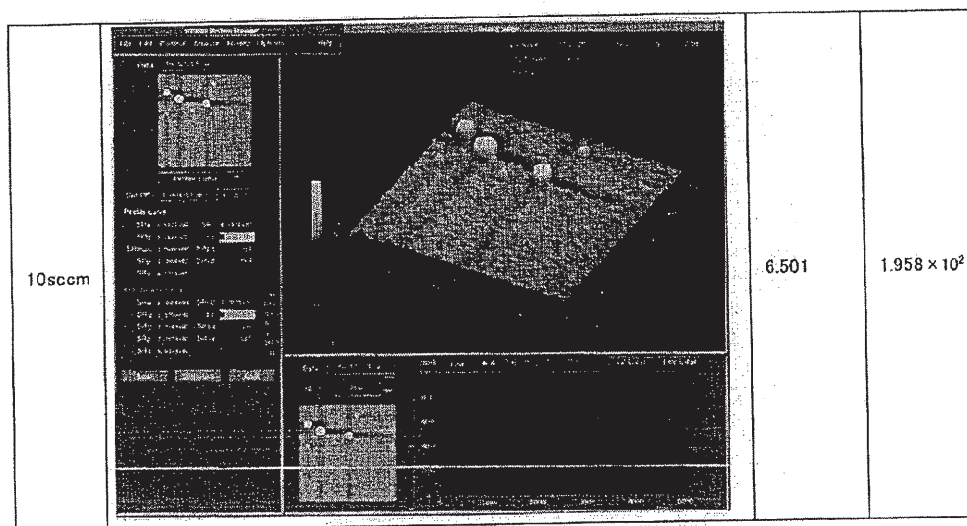


FIG. 8

(a)



(b)

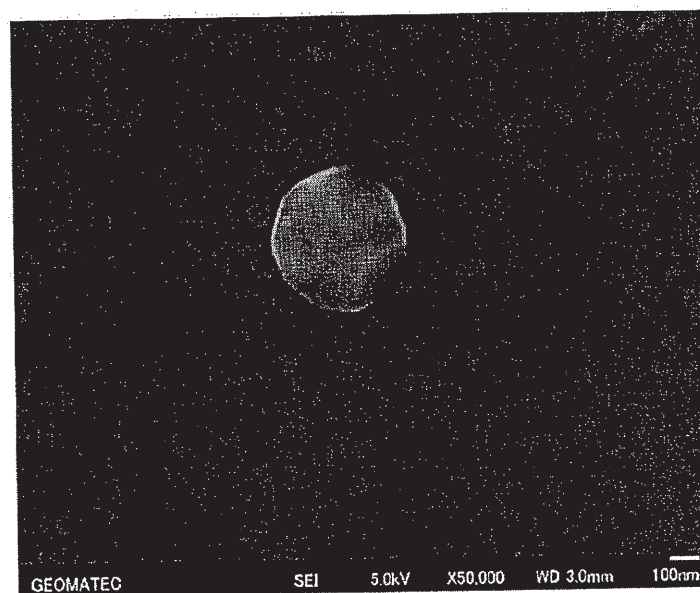
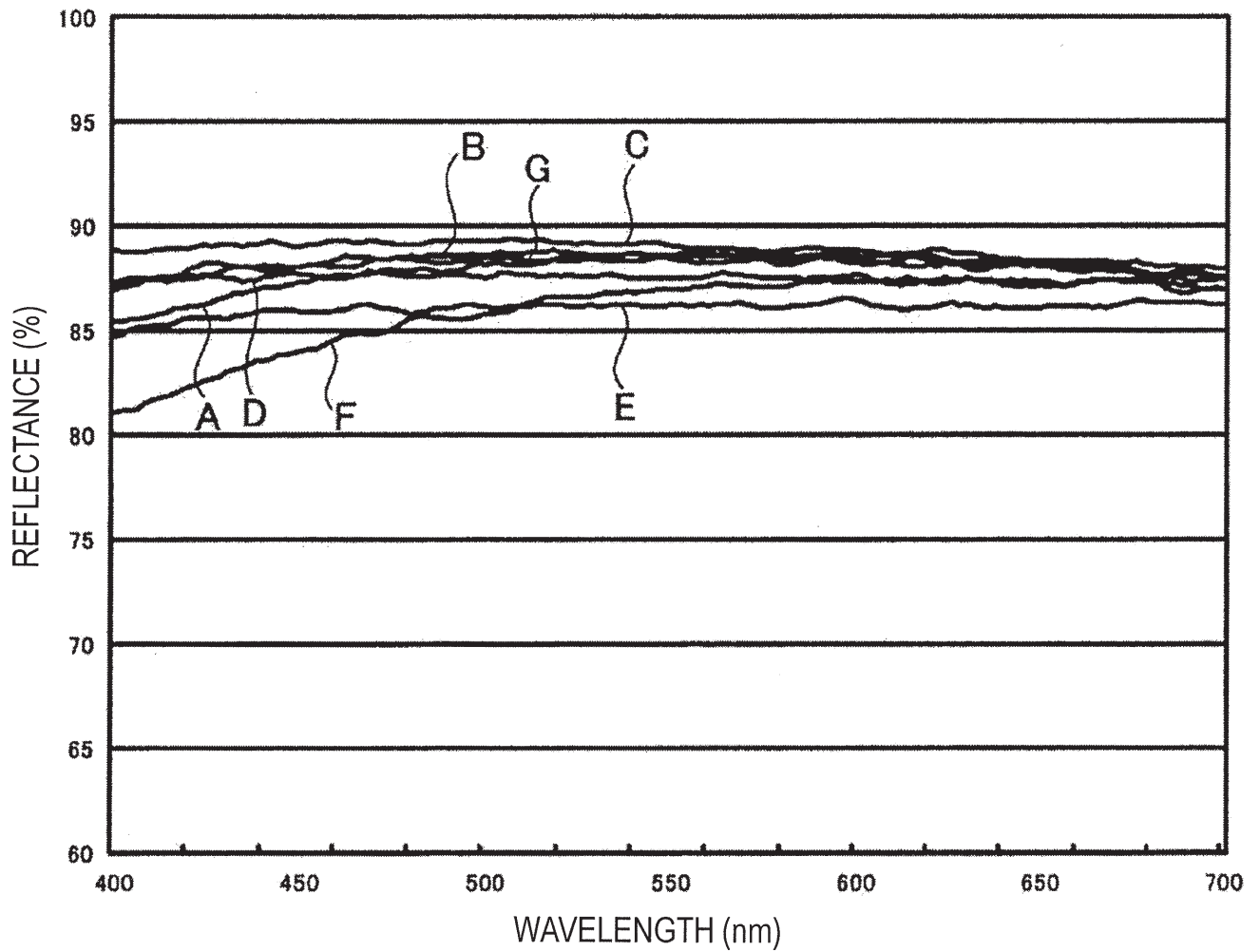


FIG. 9

A: AlTi FILM w/o N ₂	B: N ₂ : 5sccm	C: N ₂ : 10sccm	D: N ₂ : 15sccm
E: N ₂ : 20sccm	F: PURE Al w/o N ₂	G: PURE Al N ₂ : 10sccm	

FIG. 10A

WAVE-LENGTH	AlTi FILM w/o N ₂	N ₂ : 5sccm	N ₂ : 10sccm	N ₂ : 15sccm	N ₂ : 20sccm	PURE Al w/o N ₂	PURE Al N ₂ :10sccm
	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE
400	85.401	87.046	88.818	87.348	84.737	81.022	86.911
402	85.44	87.111	88.771	87.409	84.854	81.106	87.018
404	85.485	87.190	88.732	87.508	85.05	81.133	87.135
406	85.536	87.293	88.722	87.468	85.141	81.269	87.214
408	85.595	87.402	88.759	87.488	85.145	81.467	87.373
410	85.677	87.366	88.785	87.44	85.249	81.666	87.469
412	85.788	87.355	88.847	87.43	85.274	81.800	87.534
414	85.897	87.329	88.915	87.408	85.278	81.867	87.586
416	86.04	87.537	88.893	87.433	85.355	81.974	87.58
418	86.017	87.706	88.918	87.539	85.519	82.158	87.413
420	86.172	87.905	88.911	87.649	85.604	82.326	87.468
422	86.18	88.035	88.991	87.601	85.607	82.414	87.489
424	86.243	88.182	89.125	87.626	85.64	82.564	87.537
428	86.288	88.232	89.02	87.553	85.838	82.688	87.673
428	86.475	88.229	89.099	87.536	85.836	82.785	87.798
430	86.61	88.127	89.098	87.449	85.553	83.002	87.988
432	86.732	88.048	89.092	87.457	85.688	83.121	88.063
434	86.783	88.015	89.033	87.333	85.723	83.207	88.032
436	86.845	88.017	89.052	87.38	85.751	83.341	88.01
438	86.933	88.037	89.1	87.431	85.882	83.527	87.919
440	87.055	88.085	89.184	87.542	86	83.599	87.828
442	87.031	88.016	89.237	87.608	85.955	83.658	87.819
444	87.076	88.091	89.184	87.674	85.947	83.806	87.824
446	87.111	88.024	89.136	87.652	85.98	83.831	87.817
448	87.186	88.033	89.981	87.738	85.955	83.921	87.987
450	87.282	88.018	89.031	87.684	85.892	84.02	88.058
452	87.334	88.095	89.094	87.685	85.839	84.091	88.106
454	87.45	88.071	89.138	87.562	85.883	84.115	88.142
456	87.537	88.178	89.154	87.481	85.902	84.260	88.069
458	87.566	88.251	89.243	87.457	85.882	84.448	88.042
460	87.643	88.394	89.27	87.497	85.939	84.673	88.01
462	87.687	88.52	89.244	87.5	85.985	84.767	88.006
464	87.61	88.479	89.19	87.597	86.117	84.82	88.057
466	87.663	88.493	89.203	87.639	86.197	84.856	88.145
468	87.803	88.481	89.269	87.681	86.228	84.829	88.277
470	87.790	88.4	89.245	87.737	86.105	84.846	88.358
472	87.822	88.415	89.182	87.753	86.078	84.933	88.4
474	87.898	88.361	89.16	87.698	86.021	84.972	88.42
476	87.887	88.489	89.092	87.844	85.947	85.211	88.436
478	87.857	88.493	89.109	87.561	85.872	85.487	88.425
480	87.833	88.531	89.105	87.593	85.814	85.633	88.351
482	87.898	88.506	89.12	87.622	85.845	85.697	88.318
484	87.898	88.588	89.178	87.595	85.923	85.715	88.25
486	87.815	88.573	89.311	87.605	86.017	85.621	88.222
488	87.786	88.544	89.247	87.664	86.089	85.575	88.205
490	87.865	88.581	89.259	87.688	86.091	85.561	88.194
492	87.807	88.539	89.236	87.688	86.18	85.510	88.252
494	87.914	88.591	89.242	87.657	86.239	85.528	88.285
496	88.081	88.605	89.28	87.555	86.232	85.602	88.377
498	88.162	88.596	89.297	87.544	86.189	85.689	88.402
500	88.156	88.603	89.243	87.532	86.151	85.774	88.471
502	88.223	88.628	89.233	87.593	86.089	85.818	88.492
504	88.177	88.703	89.255	87.713	86.091	85.878	88.495
506	88.119	88.666	89.332	87.713	86.13	85.908	88.479
508	88.097	88.635	89.33	87.668	86.143	86.028	88.407
510	88.089	88.641	89.259	87.705	86.145	86.223	88.345
512	88.141	88.729	89.284	87.662	86.161	86.36	88.295
514	88.173	88.777	89.386	87.613	86.211	86.459	88.326
516	88.243	88.733	89.258	87.608	86.255	86.581	88.326
518	88.342	88.785	89.189	87.625	86.284	86.61	88.37
520	88.3	88.767	89.185	87.571	86.238	86.577	88.454
522	88.281	88.751	89.152	87.625	86.174	86.566	88.502
524	88.318	88.69	89.111	87.58	86.144	86.555	88.512
526	88.359	88.663	89.165	87.588	86.188	86.562	88.496

FIG. 10B

WAVE-LENGTH	AlTi FILM w/o N ₂	N ₂ : 5sccm	N ₂ : 10sccm	N ₂ : 15sccm	N ₂ : 20sccm	PURE Al w/o N ₂	PURE Al N ₂ :10sccm
	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE
520	88.392	88.604	89.154	87.589	86.22	86.62	88.481
530	88.419	88.578	89.124	87.534	86.189	86.686	88.388
532	88.435	88.57	89.101	87.637	86.187	86.749	88.33
534	88.393	88.533	89.088	87.83	86.203	86.781	88.289
538	88.381	88.603	89.054	87.544	86.227	86.78	88.274
538	88.321	88.631	89.084	87.501	86.211	86.822	88.276
540	88.317	88.638	89.108	87.489	86.227	86.779	88.333
542	88.318	88.613	89.175	87.529	86.18	86.829	88.375
544	88.378	88.573	89.204	87.52	86.134	86.907	88.424
546	88.431	88.56	89.148	87.502	86.182	86.958	88.454
548	88.487	88.579	89.111	87.498	86.179	86.994	88.449
550	88.54	88.548	89.051	87.515	86.198	86.974	88.366
552	88.564	88.631	89.078	87.493	86.202	86.988	88.321
554	88.554	88.697	89.049	87.471	86.192	86.994	88.268
556	88.545	88.698	89.014	87.484	86.184	87.084	88.172
558	88.498	88.731	89.022	87.476	86.201	87.08	88.184
560	88.584	88.716	89.034	87.621	86.191	87.125	88.228
562	88.581	88.585	89.047	87.71	86.217	87.196	88.231
564	88.618	88.581	89.073	87.728	86.243	87.188	88.234
566	88.581	88.555	89.002	87.705	86.289	87.149	88.293
568	88.573	88.577	89.058	87.639	86.3	87.113	88.335
570	88.57	88.599	89.094	87.611	86.244	87.104	88.328
572	88.583	89.009	89.009	87.59	86.147	87.047	88.38
574	88.510	88.667	89.028	87.505	86.09	87.007	88.34
576	88.421	88.684	89.039	87.5	86.04	87.039	88.292
578	88.405	88.654	89.056	87.511	86.028	87.022	88.124
580	88.425	88.659	89.025	87.514	86.088	87.086	88.127
582	88.397	88.592	89.067	87.509	86.158	87.111	88.152
584	88.434	88.514	89.042	87.471	86.118	87.213	88.181
586	88.425	88.537	89.091	87.438	86.151	87.3	88.289
588	88.509	88.573	89.073	87.447	86.207	87.279	88.424
590	88.545	88.601	89.087	87.506	86.219	87.345	88.449
592	88.581	88.69	89.009	87.488	86.303	87.395	88.421
594	88.522	88.698	89.014	87.522	86.432	87.348	88.399
596	88.51	88.724	89.013	87.549	86.488	87.347	88.293
598	88.446	88.683	89.002	87.595	86.51	87.314	88.205
600	88.401	88.518	89.025	87.628	86.395	87.295	88.173
602	88.448	88.392	89.075	87.535	86.304	87.283	88.135
604	88.437	88.219	89.024	87.368	86.187	87.273	88.153
608	88.518	88.187	89.014	87.286	86.128	87.291	88.173
608	88.577	88.194	89.096	87.281	86.09	87.355	88.175
610	88.615	89.023	89.088	87.224	86.082	87.338	88.148
612	88.62	89.023	89.062	87.154	86.009	87.422	88.087
614	88.523	88.495	89.043	87.212	85.996	87.471	88.043
616	88.444	88.551	89.078	87.252	86.075	87.374	88.008
618	88.394	88.579	89.071	87.308	86.066	87.334	88.029
620	88.309	88.545	89.089	87.253	86.102	87.336	88.101
622	88.231	88.459	89.061	87.28	86.161	87.404	88.081
624	88.23	88.378	89.092	87.212	86.254	87.478	88.168
626	88.265	88.258	89.077	87.272	86.295	87.43	88.141
628	88.247	88.174	89.057	87.311	86.191	87.42	88.103
630	88.29	88.144	89.049	87.47	86.204	87.475	87.973
632	88.314	88.066	89.042	87.389	86.118	87.379	87.859
634	88.298	88.097	89.073	87.397	86.091	87.317	87.823
636	88.205	88.127	89.08	87.403	86.063	87.291	87.911
638	88.166	88.119	89.028	87.268	86.131	87.28	87.995
640	88.132	88.108	89.095	87.126	86.082	87.353	88.058
642	88.086	88.106	89.07	87.091	86.042	87.377	88.134
644	88.081	88.103	89.069	87.069	86.084	87.348	88.194
646	88.123	88.064	89.086	87.125	86.081	87.395	88.208
648	88.157	88.079	89.083	87.022	86.079	87.31	88.145
650	88.173	88.094	89.031	87.098	86.068	87.325	88.002
652	88.129	88.074	89.031	87.07	86.13	87.286	88.035
654	88.100	88.076	89.021	87.116	86.172	87.177	87.955

FIG. 10C

WAVE-LENGTH	AlTi FILM w/o N ₂	N ₂ : 5sccm	N ₂ : 10sccm	N ₂ : 15sccm	N ₂ : 20sccm	PURE Al w/o N ₂	PURE Al N ₂ : 10sccm
	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE	INITIAL VALUE
656	88.028	88	88.253	87.038	86.14	87.124	87.868
658	87.964	87.984	88.282	87.173	86.19	87.239	87.81
660	88.037	87.904	88.283	87.219	86.185	87.269	87.777
662	88.038	87.88	88.303	87.332	86.121	87.312	87.722
664	88.104	87.937	88.297	87.408	86.096	87.354	87.84
666	88.127	87.918	88.284	87.403	86.154	87.393	87.859
668	88.123	87.909	88.278	87.433	86.104	87.441	87.819
670	88.137	87.856	88.179	87.416	86.174	87.434	87.782
672	88.082	87.881	88.244	87.336	86.235	87.379	87.824
674	87.924	87.82	88.194	87.324	86.32	87.411	87.783
676	87.778	87.826	88.253	87.267	86.409	87.355	87.64
678	87.648	87.771	88.134	87.296	86.379	87.343	87.585
680	87.629	87.624	88.079	87.3	86.327	87.298	87.454
682	87.634	87.643	88.006	87.282	86.298	87.182	87.423
684	87.654	87.558	88.087	87.254	86.303	86.832	87.48
686	87.77	87.53	88.075	87.206	86.32	86.82	87.596
688	87.9	87.448	88.06	87.158	86.355	86.77	87.642
690	87.885	87.338	88.048	87.099	86.321	86.808	87.654
692	87.871	87.35	88.061	87.009	86.343	86.891	87.698
694	87.783	87.383	88.05	86.922	86.335	86.947	87.657
696	87.645	87.364	88.053	86.821	86.275	86.995	87.577
698	87.6	87.371	87.964	86.955	86.261	87.012	87.499
700	87.581	87.45	87.931	86.889	86.216	86.961	87.467
AVERAGE	87.849	88.244	88.827	87.453	86.054	85.972	88.051

FIG. 11

HV CONVERTED HARDNESS		NHT HARDNESS MEASUREMENT			ADHERENCE TEST	
AlTi FILM	NHT HARDNESS[GPa]		YOUNG'S MODULUS[GPa]	MAXIMUM INDENTER DEPTH [nm]	VICKERS INDENTATION	SCRATCHES
WITHOUT SUPPLY OF N2	1.0	96.6	73.9	193.7	NO PEELING	
N2 5sccm	1.7	155.8	78.0	154.1		
N2 10sccm	2.1	194.7	77.7	140.7		
N2 15sccm	2.4	225.7	95.3	130.4		
N2 20sccm	2.5	229.2	82.5	131.2		

FIG. 12

Avg. SPECIFIC RESISTANCE [$\mu\Omega\text{cm}$]

AlTi FILM w/o N ₂	FILM THICKNESS	659	665	674	666.90	5.552
	RESISTANCE VALUE	0.0839	0.0839	0.0826	0.0833	
N ₂ :5sccm	FILM THICKNESS	783	791	808	796.05	7.758
	RESISTANCE VALUE	0.1005	0.0970	0.0944	0.0975	
N ₂ :10sccm	FILM THICKNESS	742	741	766	754.70	9.966
	RESISTANCE VALUE	0.1366	0.1314	0.1275	0.1321	
N ₂ :15sccm	FILM THICKNESS	766	788	790	778.75	13.317
	RESISTANCE VALUE	0.1775	0.1675	0.1645	0.1710	
N ₂ :20sccm	FILM THICKNESS	736	748	763	749.90	17.311
	RESISTANCE VALUE	0.2392	0.2152	0.2225	0.2309	

FIG.13

AMOUNT OF CONSTITUENTS [wt%]

Et (sec)		10sec	30sec	60sec	120sec
WITHOUT SUPPLY OF N2 N2=0 sccm	O	20.7	10.2	2.7	3.1
	Ti	0.8	1.9	1.8	1.5
	N	—	—	—	—
	Al	78.5	87.8	95.5	95.3
	C	—	—	—	—
WITH SUPPLY OF N2 N2=5 sccm	O	21.9	1.8	1.6	1.1
	Ti	0.0	1.5	1.2	1.0
	N	0.5	0.7	0.6	0.9
	Al	77.5	96.1	96.7	97.1
	C	—	—	—	—
WITH SUPPLY OF N2 N2=10 sccm	O	16.0	5.2	1.9	1.8
	Ti	0.0	1.1	1.8	1.3
	N	1.2	1.5	1.8	2.0
	Al	82.8	92.1	94.4	94.9
	C	—	—	—	—
WITH SUPPLY OF N2 N2=15 sccm	O	21.3	2.5	2.9	2.2
	Ti	0.0	1.1	1.6	1.9
	N	1.5	2.9	3.5	4.1
	Al	77.2	93.6	92.0	91.8
	C	—	—	—	—
WITH SUPPLY OF N2 N2=20 sccm	O	20.6	4.7	6.6	4.5
	Ti	0.0	1.5	1.0	1.4
	N	2.2	4.5	5.2	5.7
	Al	77.2	89.3	87.2	88.5
	C	—	—	—	—

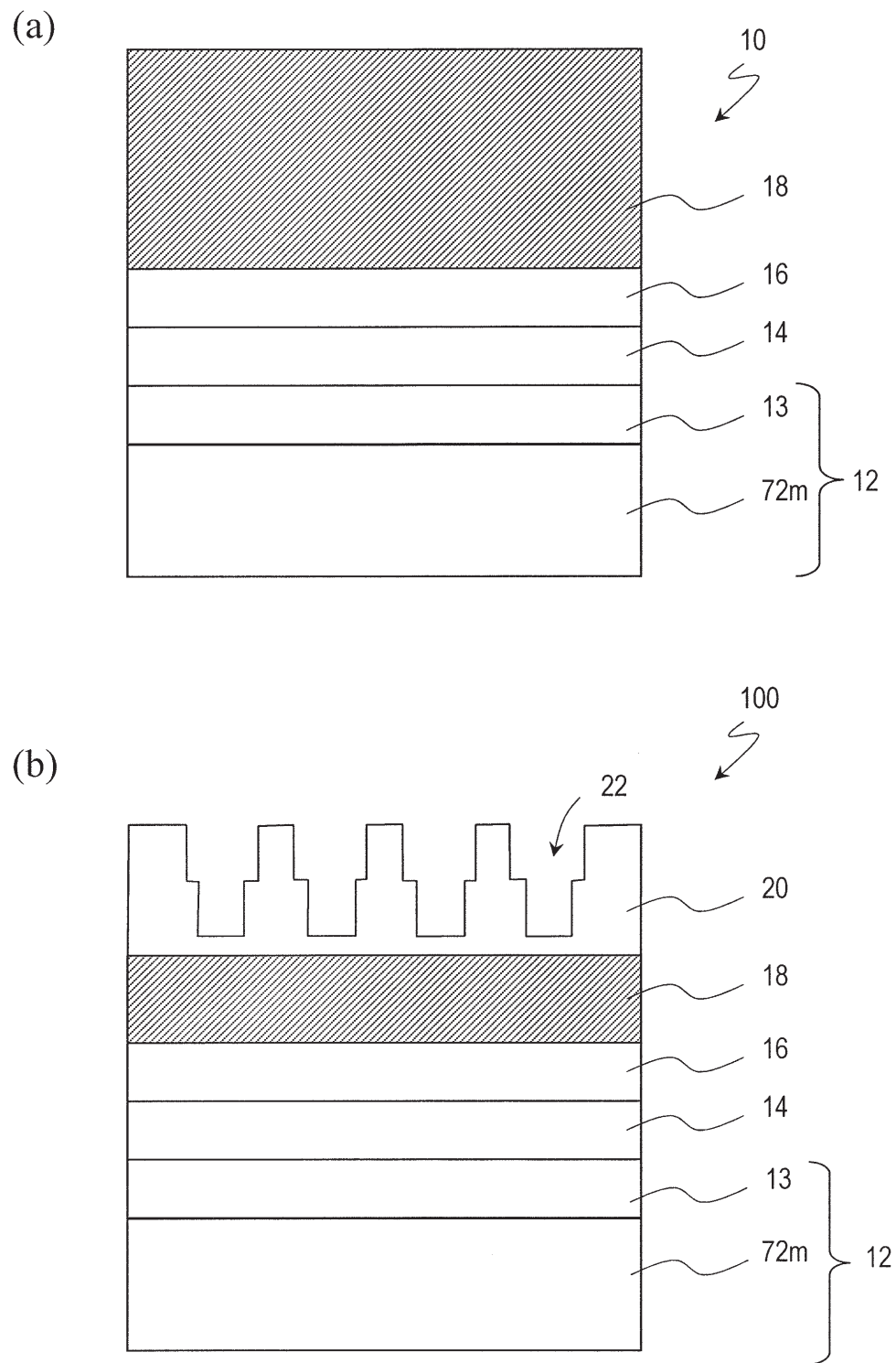
FIG. 14

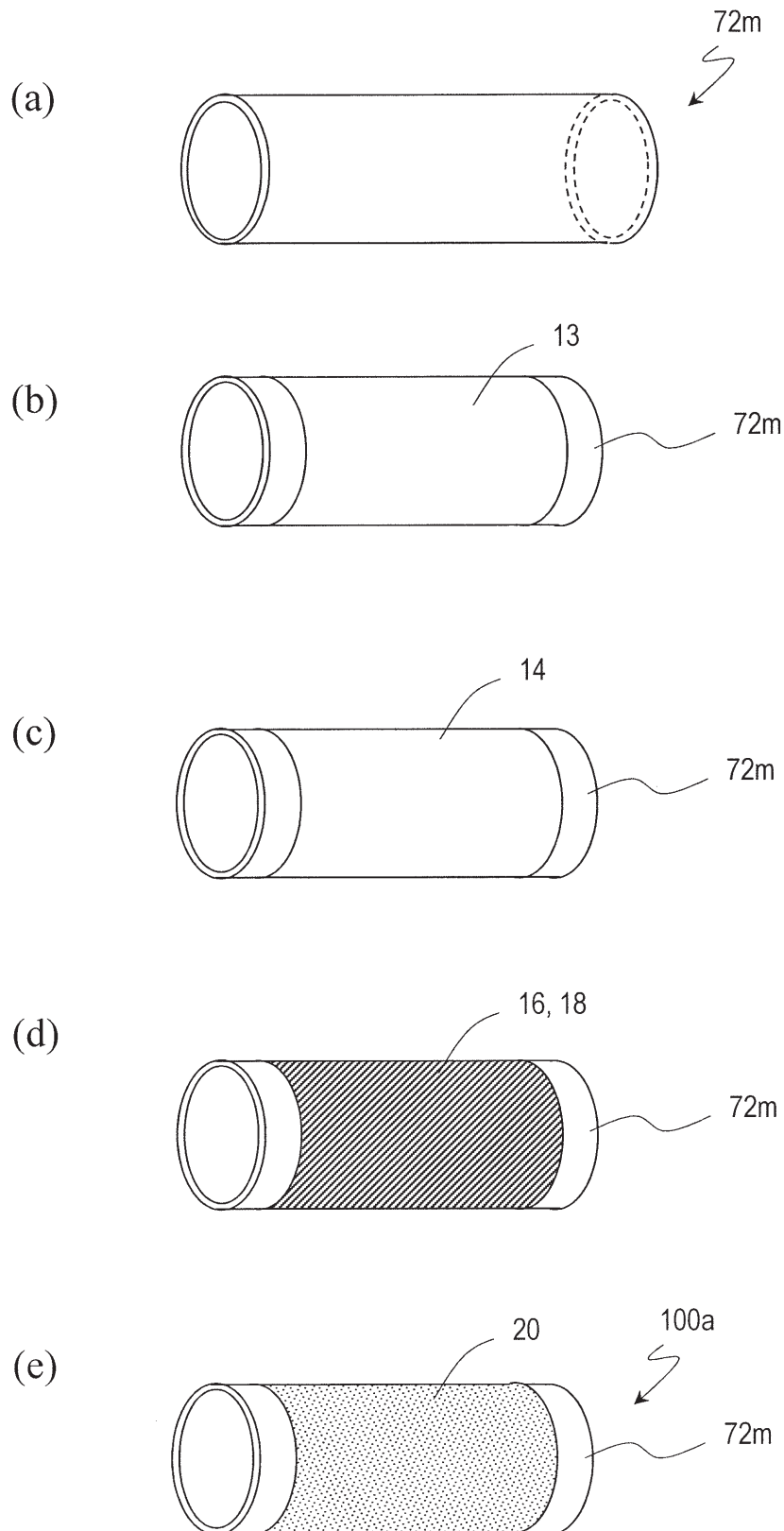
FIG. 15

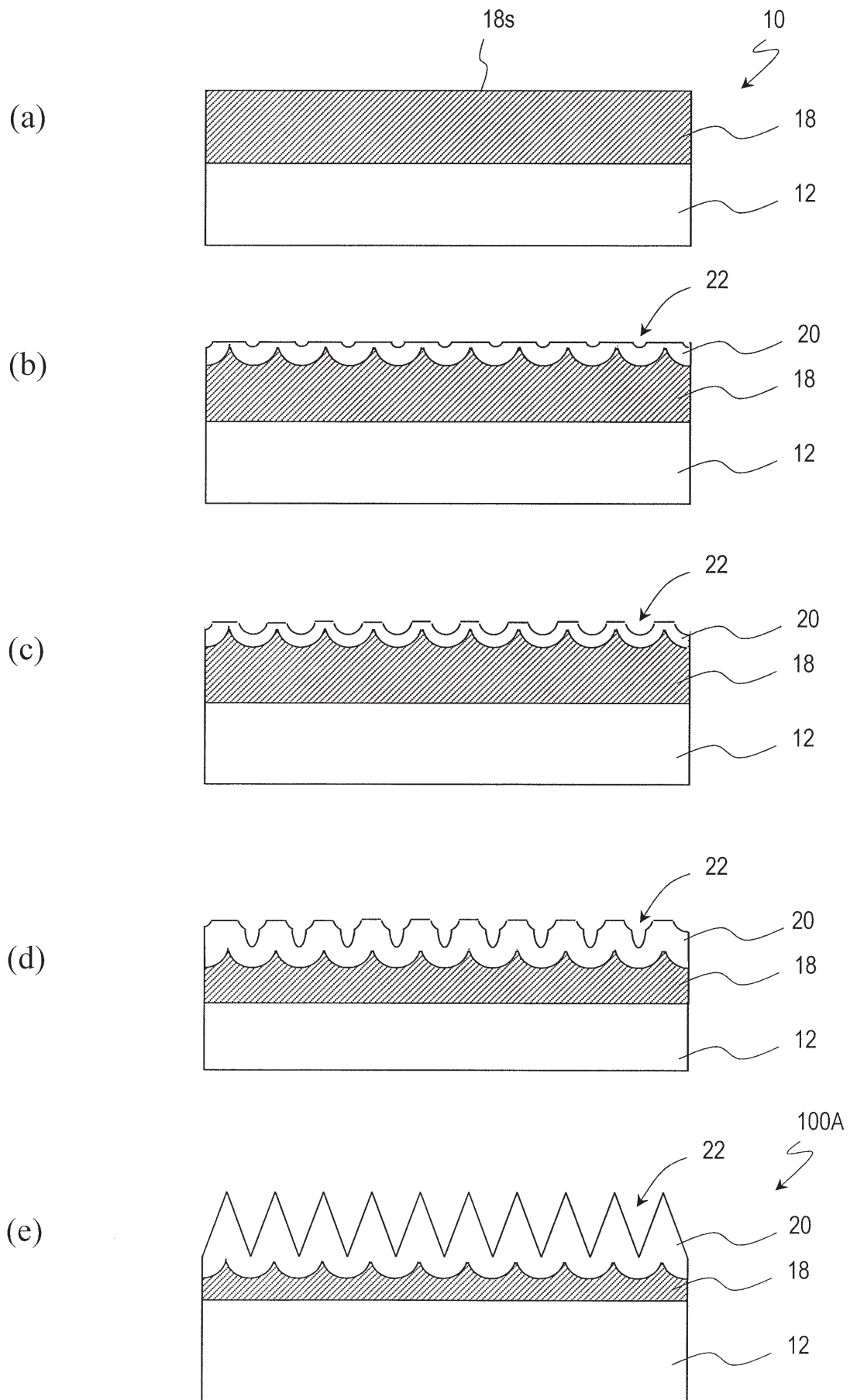
FIG. 16

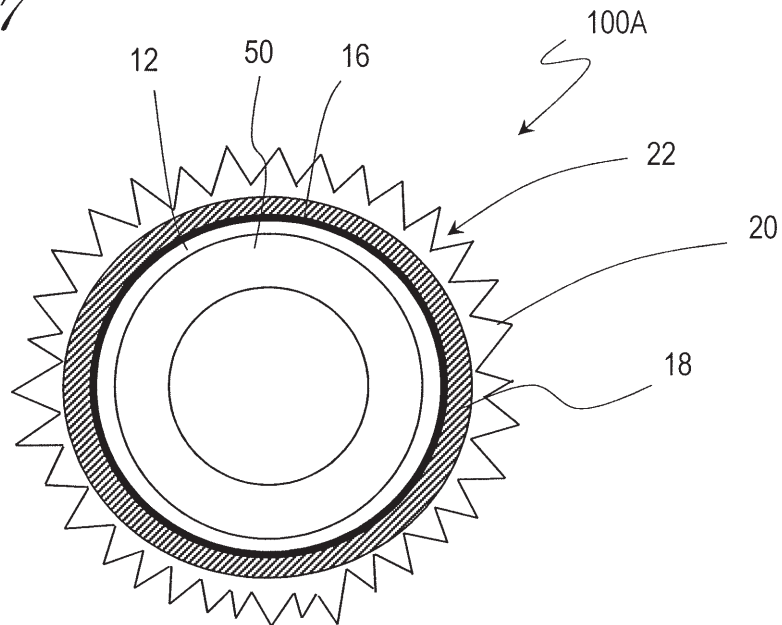
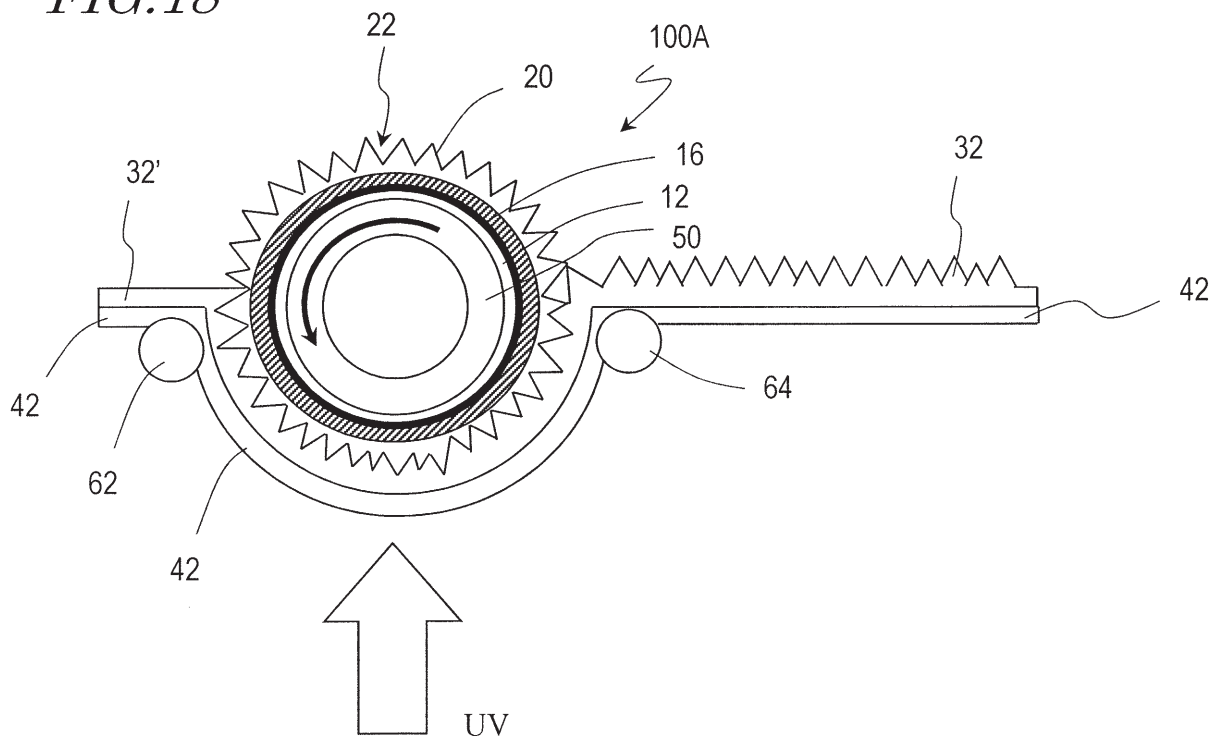
FIG. 17*FIG. 18*

FIG. 19

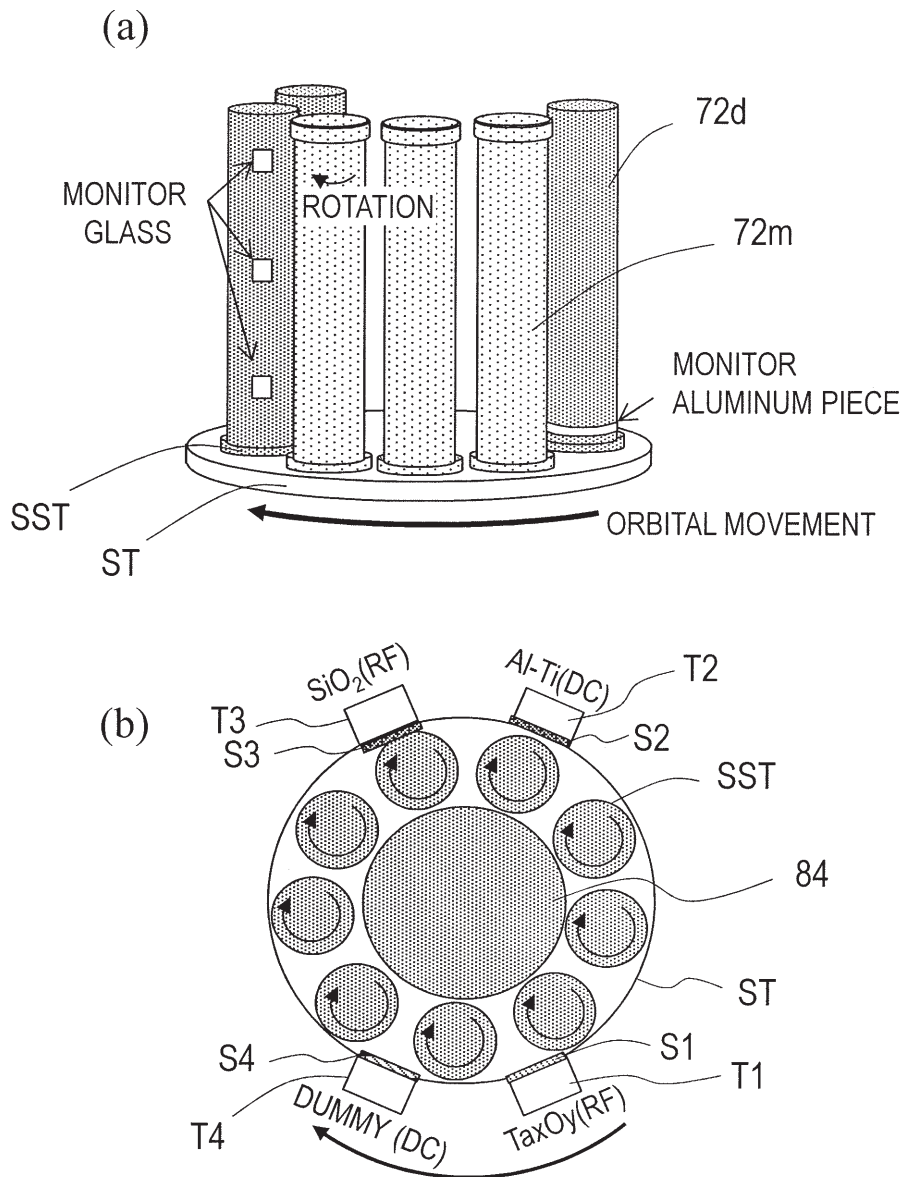
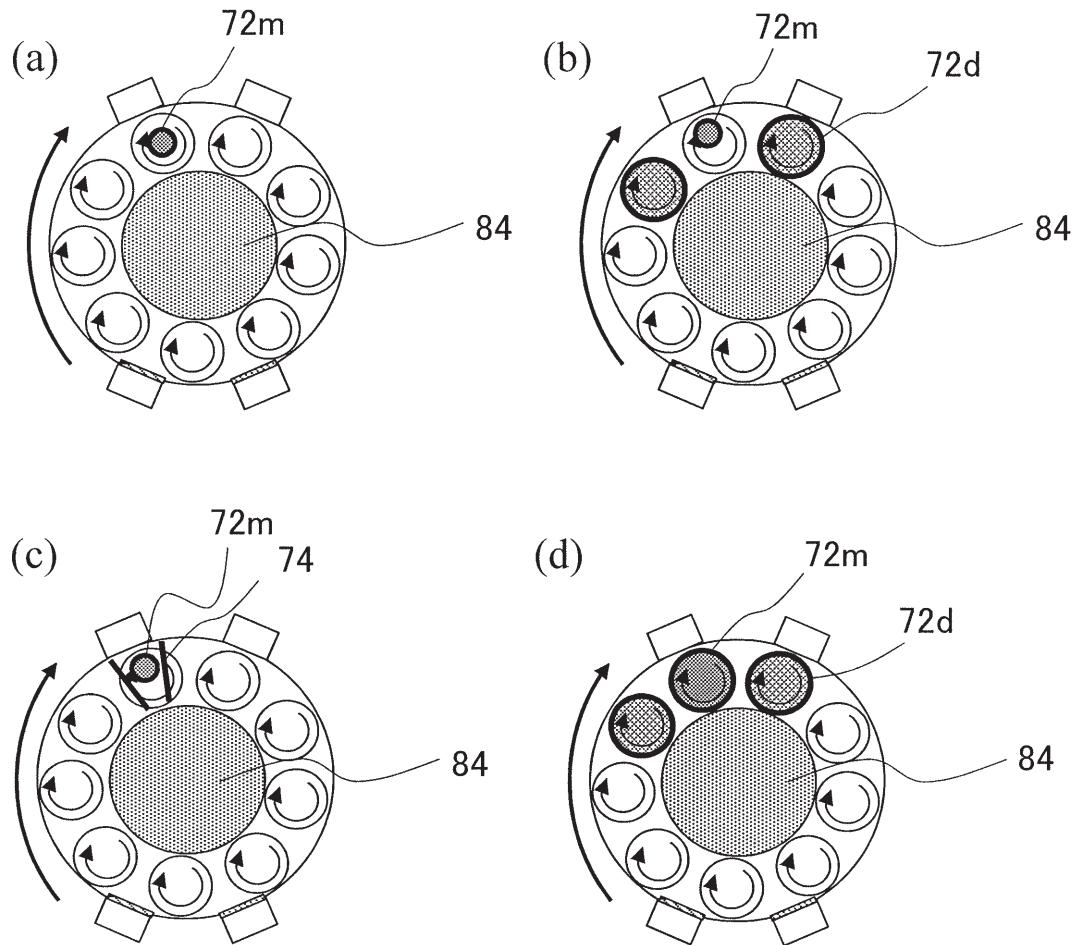


FIG.20*FIG.21*

SAMPLES	TARGET DISTANCE	N2	SHIELD MEMBER	Y VALUE OF CR331	
				1st POINT	2nd POINT
A	14.5cm	×	×		
B	10cm	○	DISTANT	10.38	
C	10cm	○	○	4.75	5.22
D	10cm	○	○	4.72	
E	7cm	×	○	12.81	9.99
F	7cm	×	○	16.4	14.1
G	7cm	○	○	2.20	2.19
H	7cm	○	○	2.13	2.17
COMPAR- ATIVE	NO DEPOSITION			5.17	

SAME CONDITIONS (rows C, D)
 SAME CONDITIONS (rows E, F)
 SAME CONDITIONS (rows G, H)

FIG.22

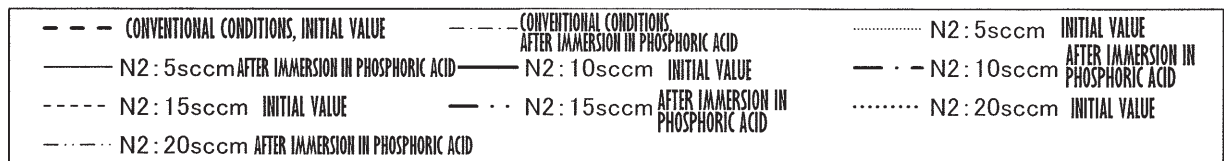
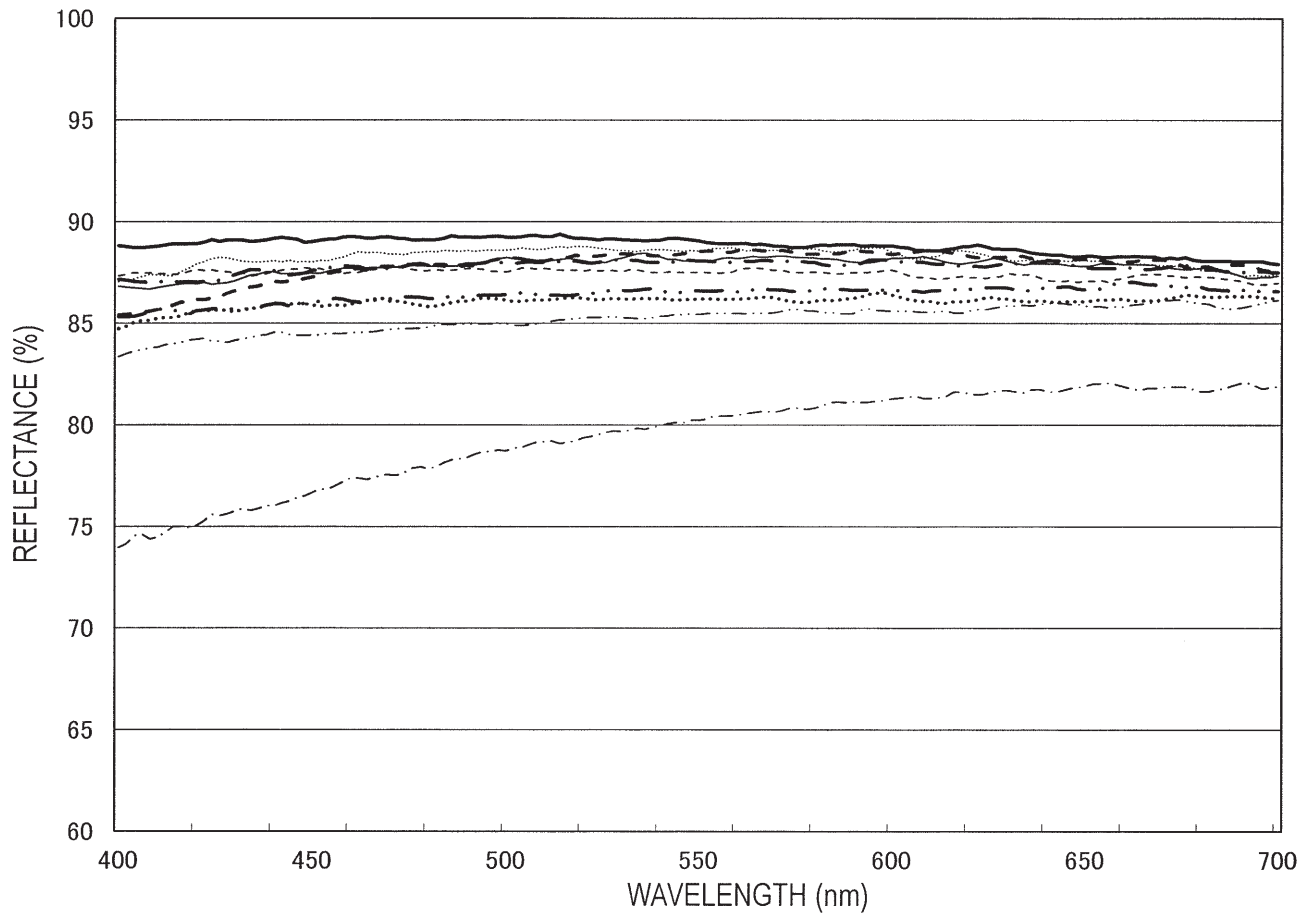


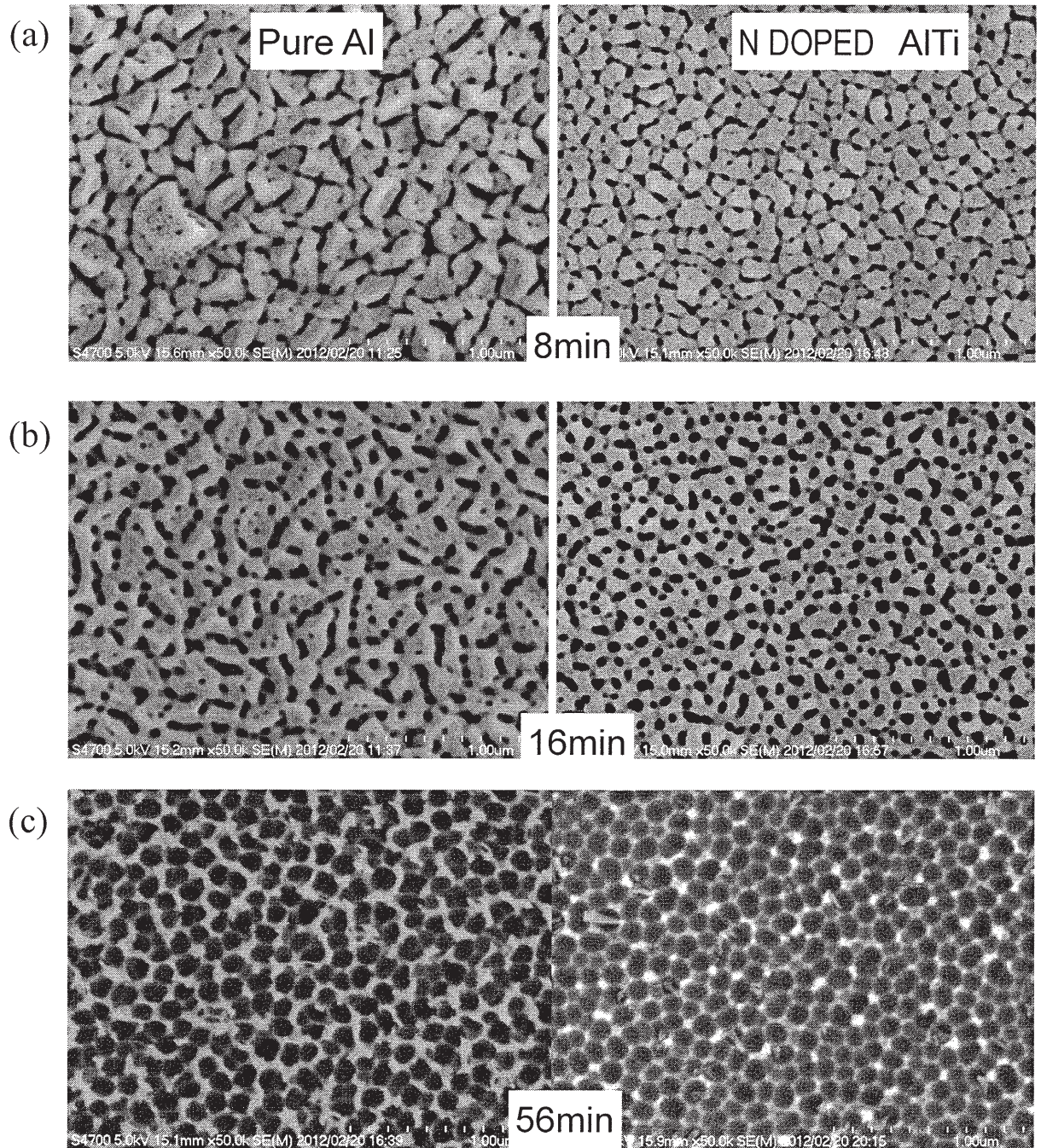
FIG.23

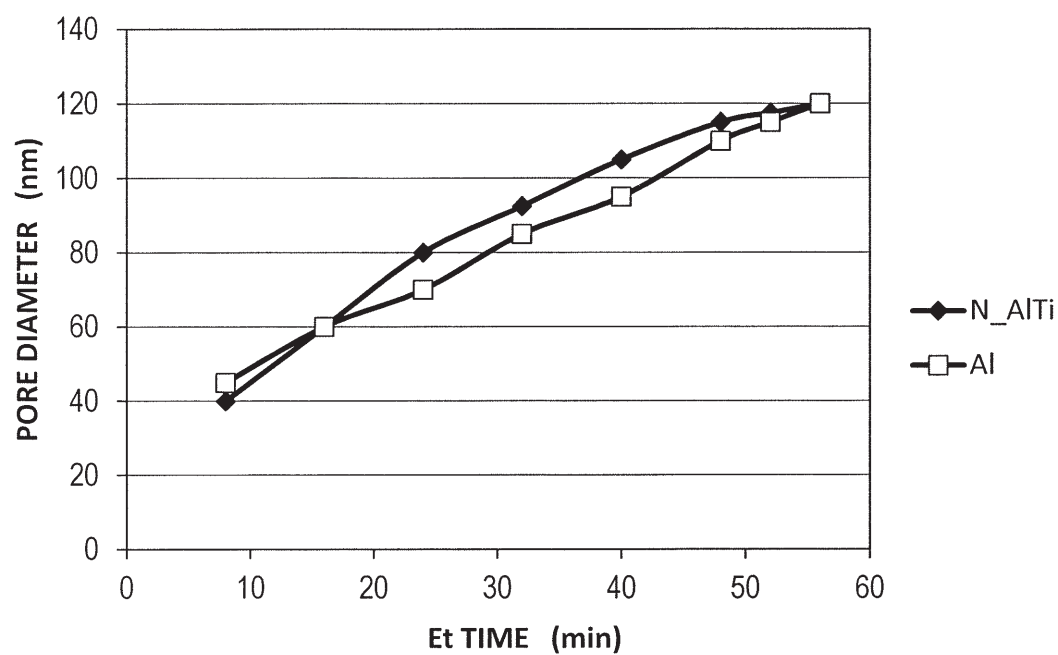
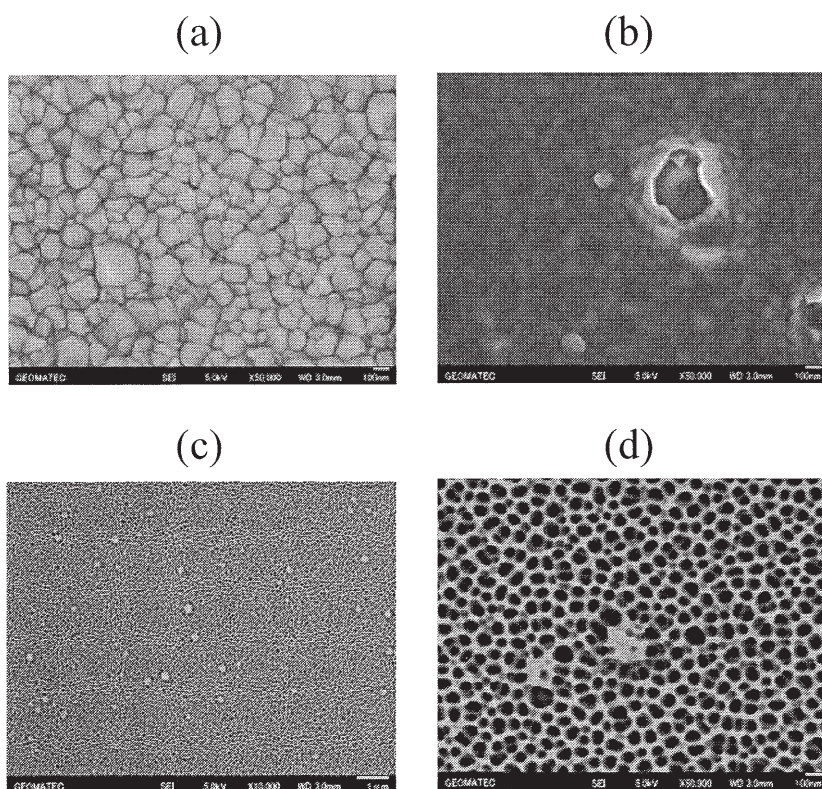
FIG.24*FIG.25*

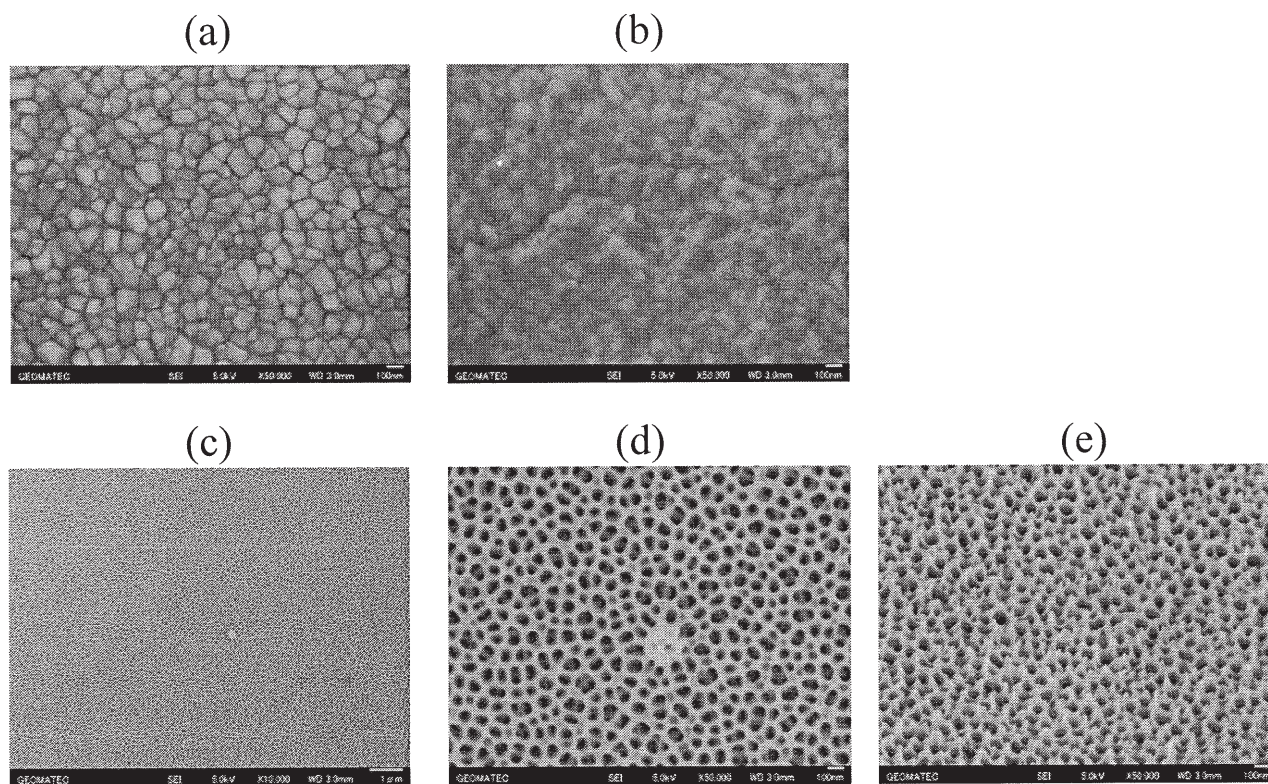
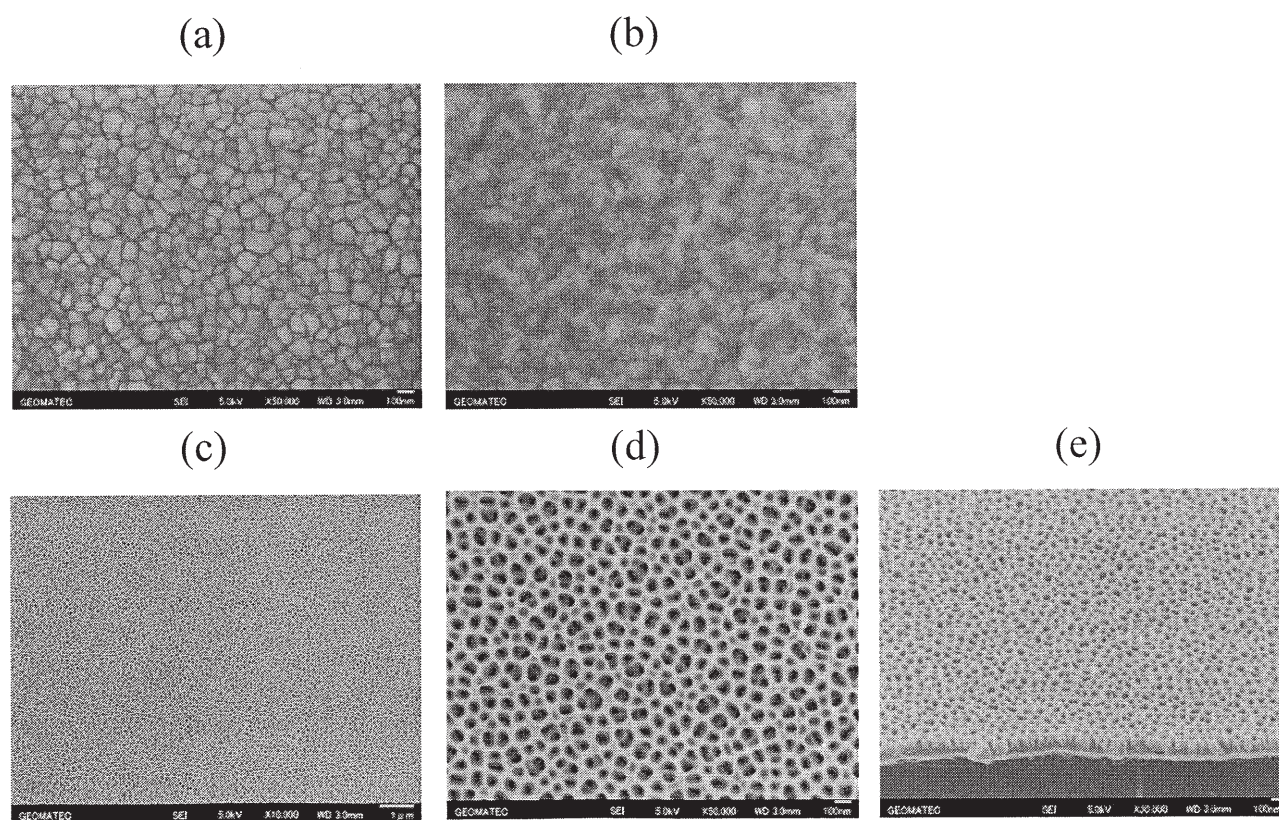
FIG.26*FIG.27*

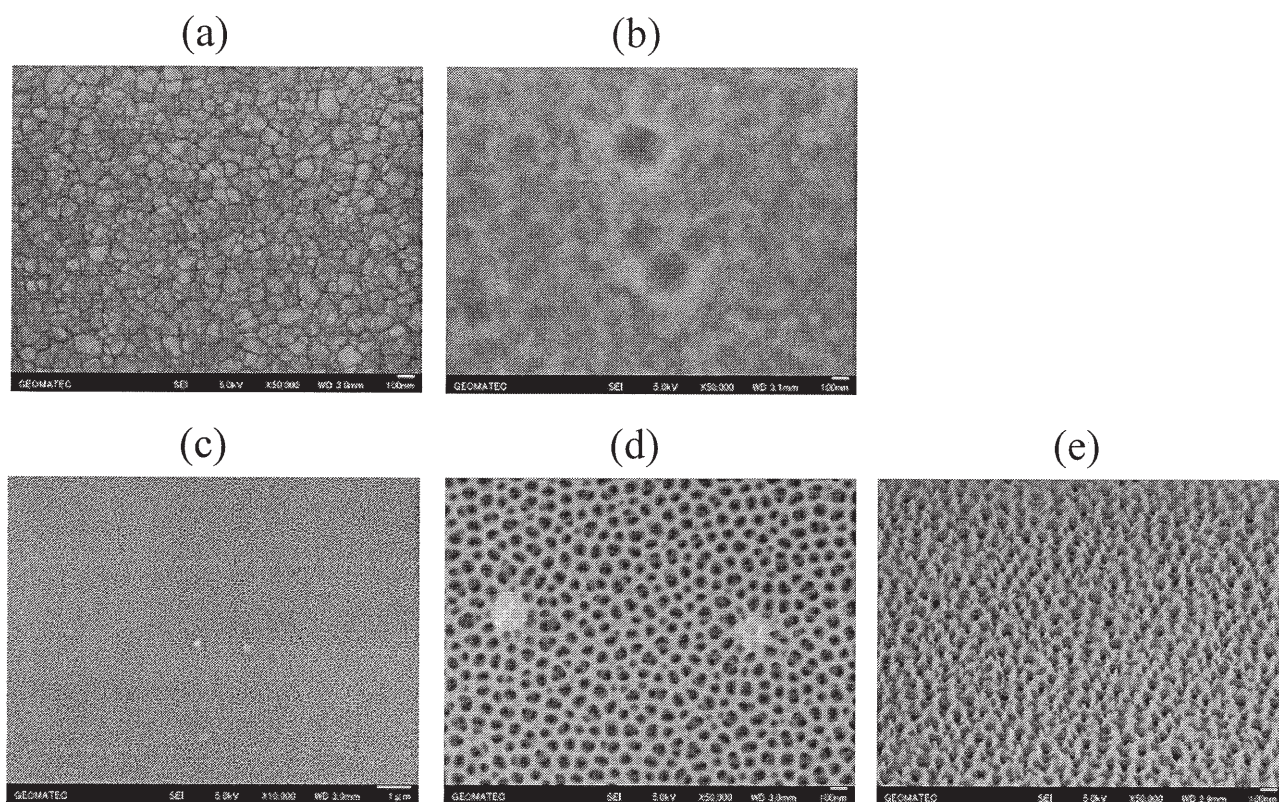
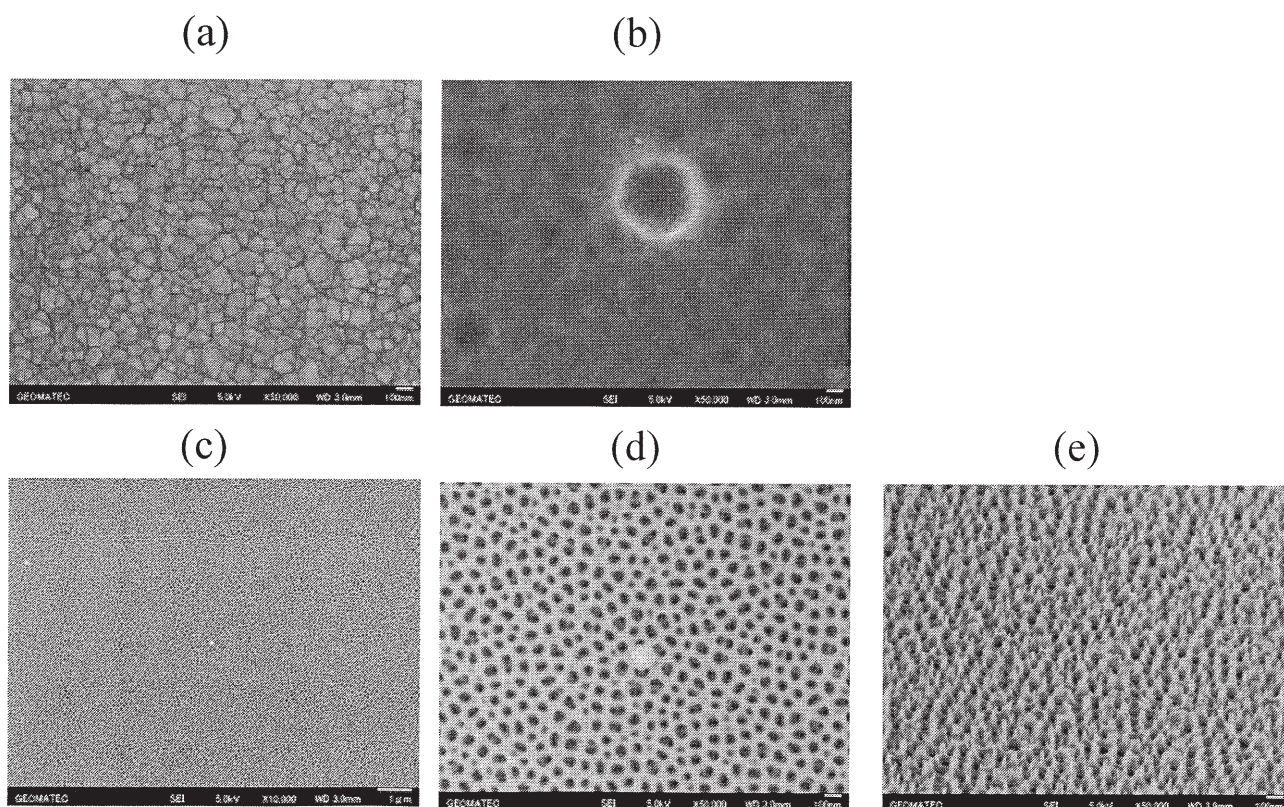
FIG.28*FIG.29*

FIG.30

Et (sec)		10sec	30sec	60sec	120sec	180sec
WITHOUT SUPPLY OF N ₂ N ₂ =0sccm	O	44.7	44.0	43.9	41.6	1.7
	Ti	0.0	0.0	0.0	0.0	0.9
	N	0.0	0.0	0.0	0.0	0.0
	Al	55.3	56.0	56.1	58.4	97.4
	C	0.0	-	-	-	-
WITH SUPPLY OF N ₂ N ₂ =10sccm	O	43.2	43.1	42.2	36.5	8.0
	Ti	0.0	0.0	0.0	0.0	0.0
	N	0.8	1.1	0.5	0.9	2.1
	Al	56.0	55.8	57.3	62.6	88.0
	C	0.0	-	-	-	-
WITH SUPPLY OF N ₂ N ₂ =15sccm	O	43.5	42.4	42.4	36.7	11.3
	Ti	0.0	0.0	0.0	0.7	0.7
	N	0.7	0.9	0.9	1.4	3.5
	Al	55.9	56.7	56.7	61.3	84.4
	C	-	-	-	-	-
WITH SUPPLY OF N ₂ N ₂ =20sccm	O	43.5	42.6	42.3	33.8	10.5
	Ti	0.0	0.0	0.0	0.4	1.0
	N	0.8	1.2	1.1	1.7	4.4
	Al	55.7	56.2	56.6	64.2	84.1
	C	-	-	-	-	-

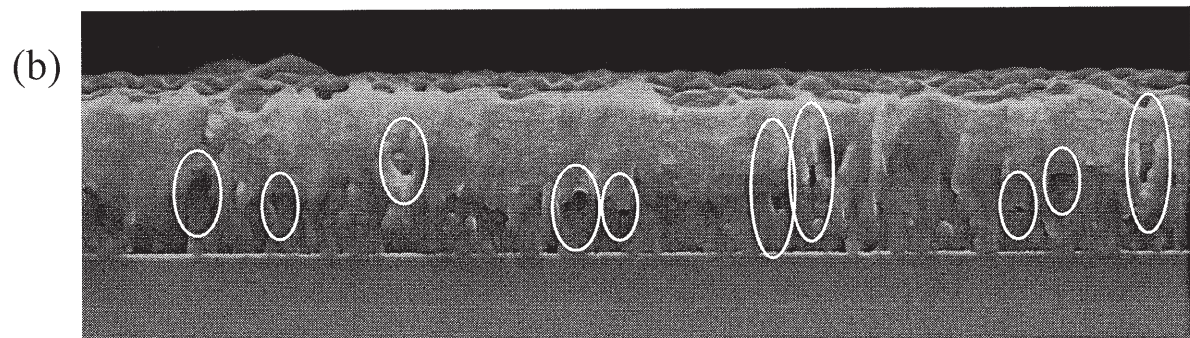
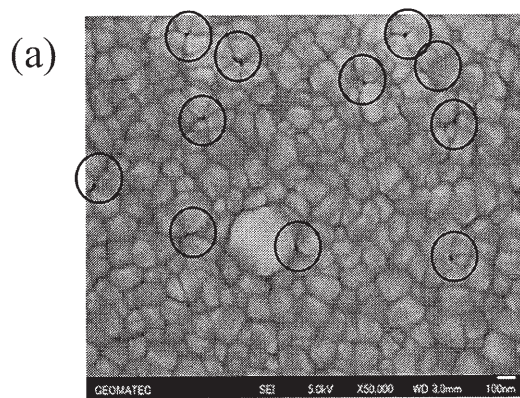
FIG.31

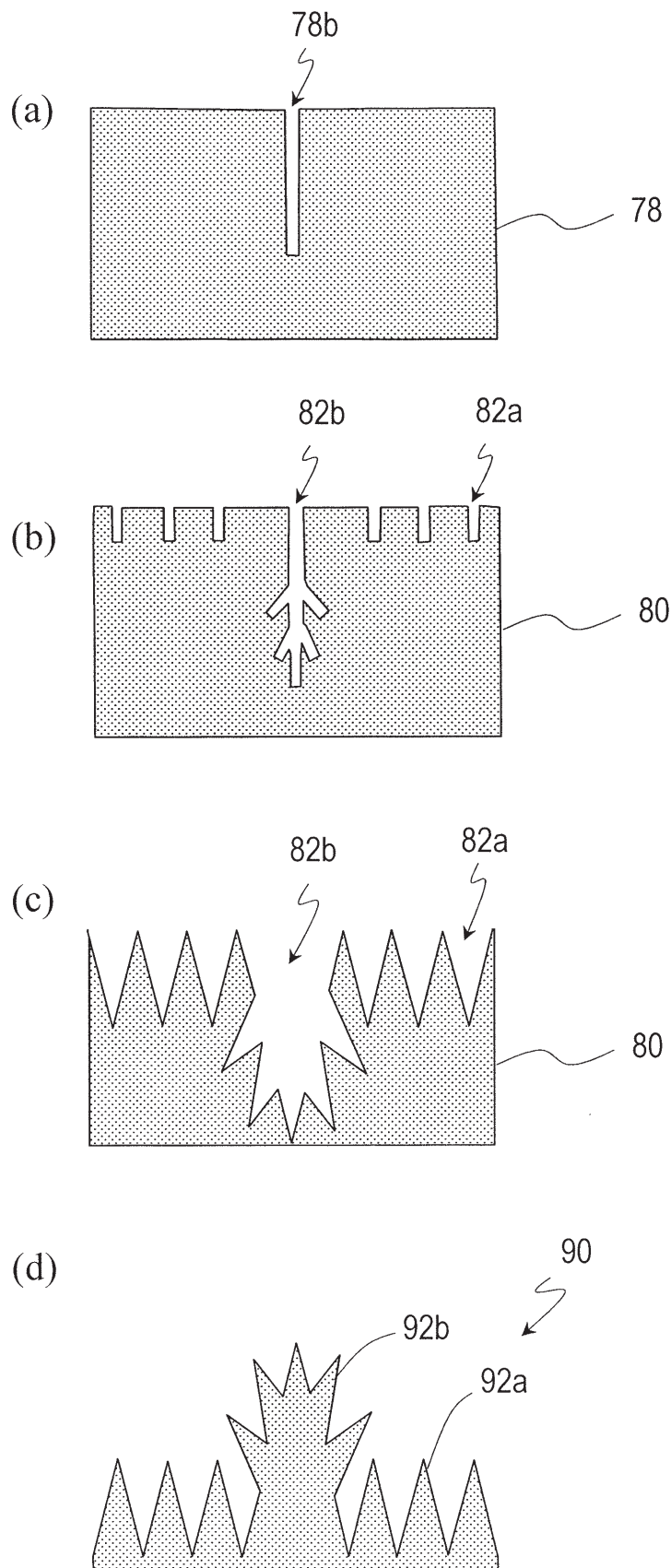
FIG. 32

FIG.33