

Nyberg (1999) has shown that silicon nitride (SiN_x) grown by Plasma Enhanced Chemical Vapor Deposition (PECVD) is a promising candidate for an antireflection coating (ARC) on commercial crystalline silicon solar cells. Silicon nitride was grown on polished (100)-oriented 4A silicon wafers using a parallel plate Plasma Technology PECVD reactor. The diameter of the electrodes of the PECVD is 24 cm and the diameter of the shower head (through which the gases enter) is 2A. The RF frequency was 13.56 MHz. The thickness of the silicon nitride was one-quarter of the wavelength of light in the nitride, the wavelength being 640 nm. This wavelength is expected to be close to optimal for silicon solar cell purposes. The process gases were ammonia and a mixture of 3% silane in argon. The experiments were carried out according to a 2⁵ factorial design. The results are shown in the following.

	A	B	C	D	E	y_1	y_2
	Silane to Ammonia	Total Gas Flow					
Exp. No.	Flow Rate Ratio	Rate (sccm)	Press. (mtorr)	Temp. (C°)	Power (W)	Refract. Index	Growth Rate (nm/min)
1	0.1	40	300	300	10	1.92	1.79
2	0.9	40	300	300	10	3.06	10.1
3	0.1	220	300	300	10	1.96	3.02
4	0.9	220	300	300	10	3.33	15
5	0.1	40	1200	300	10	1.87	19.7
6	0.9	40	1200	300	10	2.62	11.2
7	0.1	220	1200	300	10	1.97	35.7
8	0.9	220	1200	300	10	2.96	36.2
9	0.1	40	300	460	10	1.94	2.31
10	0.9	40	300	460	10	3.53	5.58
11	0.1	220	300	460	10	2.06	2.75
12	0.9	220	300	460	10	3.75	14.5
13	0.1	40	1200	460	10	1.96	20.7
14	0.9	40	1200	460	10	3.14	11.7
15	0.1	220	1200	460	10	2.15	31
16	0.9	220	1200	460	10	3.43	39
17	0.1	40	300	300	60	1.95	3.93
18	0.9	40	300	300	60	3.16	12.4
19	0.1	220	300	300	60	2.01	6.33
20	0.9	220	300	300	60	3.43	23.7
21	0.1	40	1200	300	60	1.88	35.3
22	0.9	40	1200	300	60	2.14	15.1
23	0.1	220	1200	300	60	1.98	57.1
24	0.9	220	1200	300	60	2.81	45.9
25	0.1	40	300	460	60	1.97	5.27
26	0.9	40	300	460	60	3.67	12.3
27	0.1	220	300	460	60	2.09	6.39
28	0.9	220	300	460	60	3.73	30.5
29	0.1	40	1200	460	60	1.98	30.1
30	0.9	40	1200	460	60	2.99	14.5
31	0.1	220	1200	460	60	2.19	50.3
32	0.9	220	1200	460	60	3.39	47.1