N87-16426

LOW-PRESSURE, CHEMICAL VAPOR DEPOSITION POLYSILICON

JET PROPULSION LABORATORY

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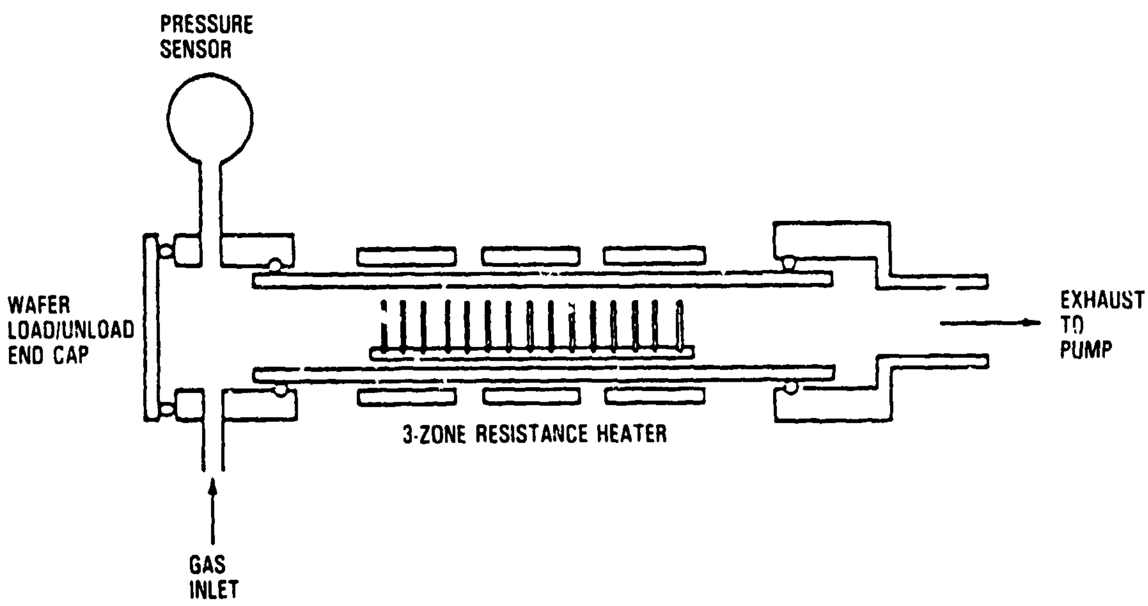
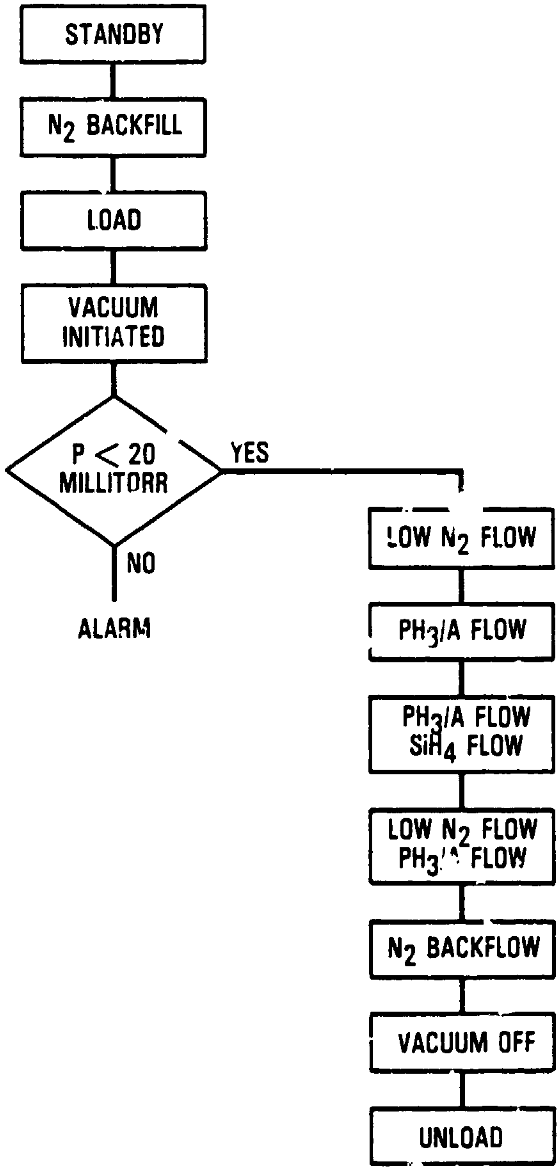
Polysilicon is Used for Contact Passivation to:

- Lower surface recombination velocity
- Increase Voc
- Increase cell efficiency

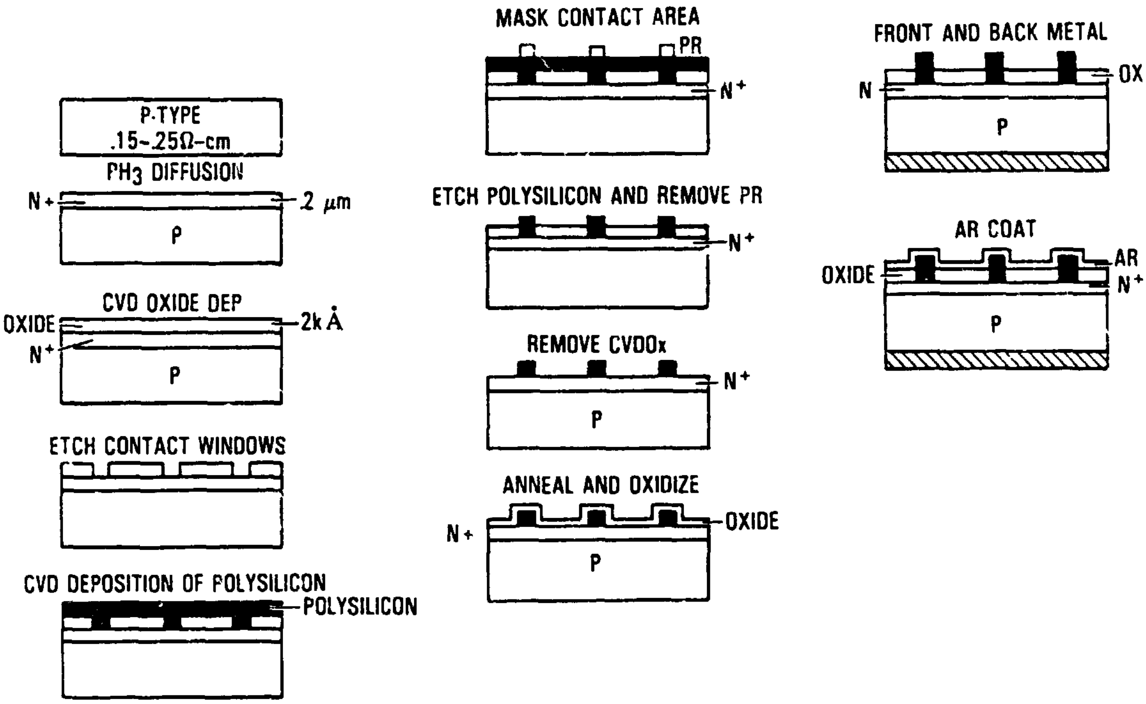
Reactor for LPCVD Polysilicon



Algorithm for the LPCVD Polysilicon Process



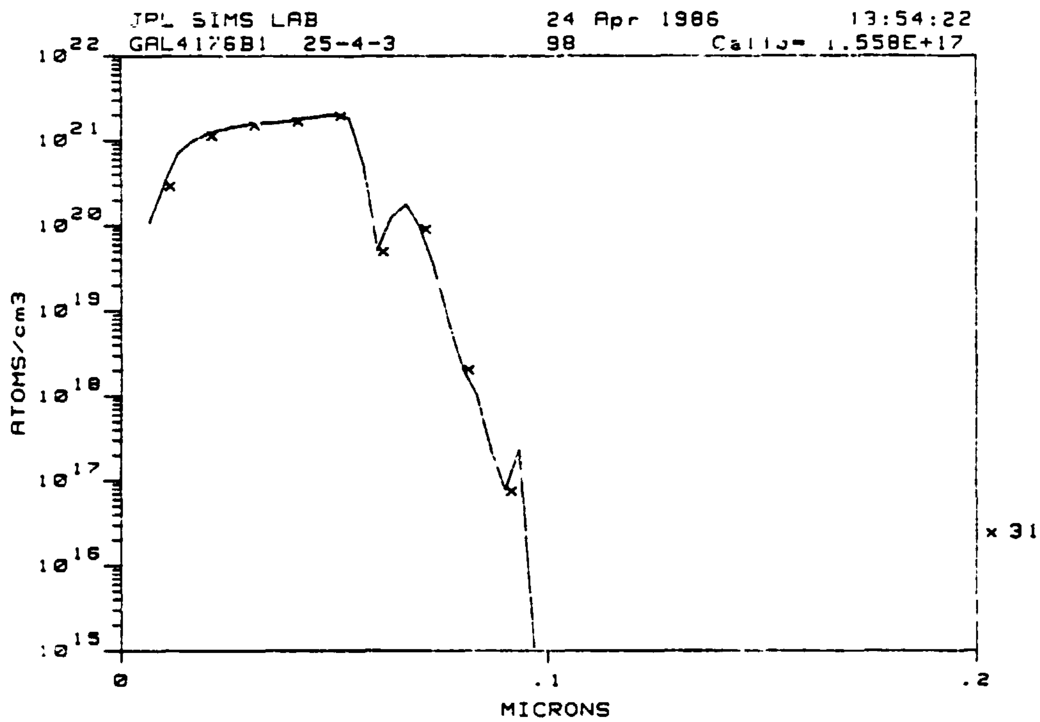
Flow Diagram for the LPCVD Polysilicon Process



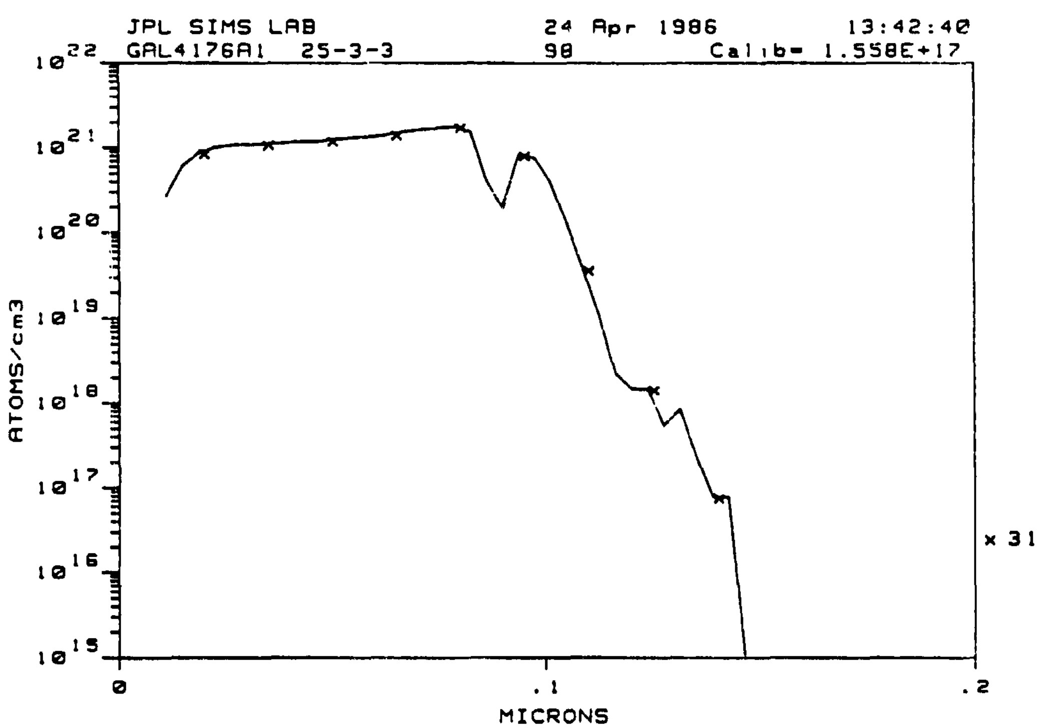
Sheet Resistance

$[PH_3]/[SiH_4]$	TIME (min)	AS DEPOSITED (ohms/square)	POST ANNEAL (ohms/square)
2.5×10^{-2}	60	2320	178
	120	1616	138
	180	863	70

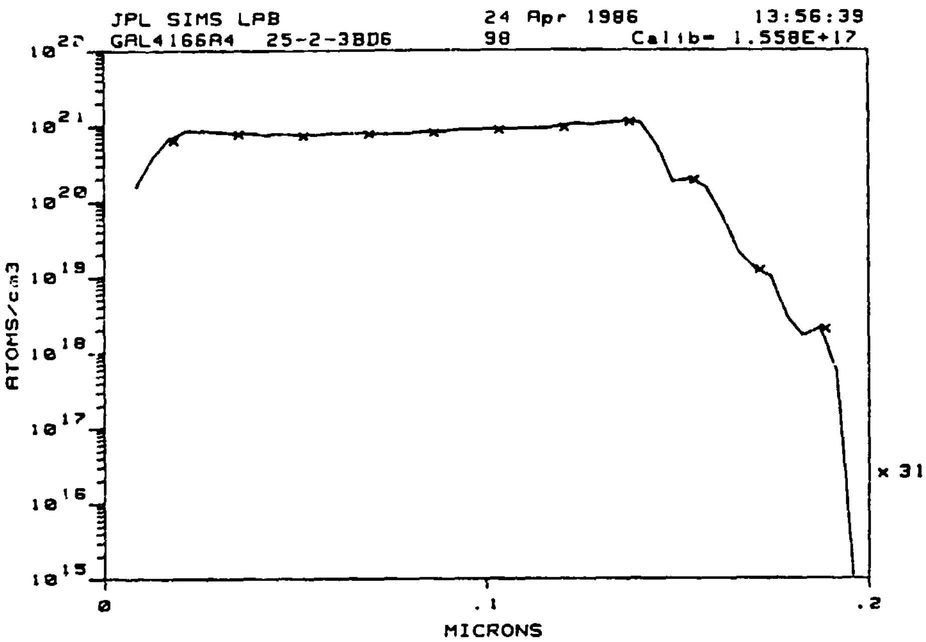
Secondary Ion Mass Spectroscopy Plot (25-4-3)



Secondary Ion Mass Spectroscopy Plot (25-3-3)



Secondary Ion Mass Spectroscopy Plot (25-2-3BD6)



Preliminary Electrical Results
(In-Situ Polysilicon Doped with $[PH_3]/[SiH_4]$ Ratio of 2.5×10^{-2})

	Voc	Isc	FF	η	t	ρ_s
151-1	639.5	128.5	813	16.72	1.51kÅ	70
151-2	638.5	127.5	812	16.52	30-40Å	VL
151-3	645.3	125.0	811	16.36	400Å	VL
151-4	637.2	132.8	807	17.08	160Å	VL
151-5	650.6	130.0	811	17.15	1kÅ	138
151-6	648.0	128.6	811	16.81	200Å	VL
151-7	643.9	129.5	799	16.65	Control	

Conclusions

- **LPCVD System Operational**
- **Preliminary Electrical Results Encouraging**

Module and Reliability Technology

MODULE TECHNOLOGY

Melvin I. Smokler, Chairman

R. Mueller, of JPL, described the measurement system requirements to obtain accurate electrical performance measurements of amorphous silicon cells and modules, and reviewed progress in modifying the JPL system toward that objective.

R. Ross, Jr., of JPL, discussed the JPL program of developing qualification tests necessary for amorphous silicon modules, including appropriate accelerated environmental tests that reveal degradation due to illumination. Data were given showing the results of temperature-controlled field tests and the results of accelerated tests in an environmental chamber.

J. Lathrop, of Clemson University, reported progress and initial data on accelerated stress tests on small amorphous silicon test samples from several manufacturers. The test samples included both single and tandem junction devices.

D. Otth, of JPL, presented the results of a current set of accelerated long-term endurance tests on crystalline silicon modules of various constructions. Cell materials include single crystal, semicrystal, EFG ribbon, and dendritic web ribbon. The latest data set is for the equivalent of 20-year life and showed satisfactory performance.

P. Willis, of Springborn Laboratory, reviewed work on identifying and developing low-cost module encapsulation materials. Test results were displayed for a variety of materials. The improved prospects for modeling encapsulation systems for life prediction were reported.

M. Smokler, of JPL, presented the results of a program of qualification testing of commercial crystalline silicon modules from nine manufacturers in five countries. The outcome demonstrated the effective role of the Block V Qualification Tests in the development of reliable modules.

M. Spitzer, of Spire Corp., reported success in meeting the long-sought goal of manufacturing a crystalline silicon module with efficiency of 15% or better. Encapsulated cell efficiencies as high as 17.6% were obtained.

B. Jackson, of JPL, reviewed the role and some results of the project analysis and integration function in the FSA Project. Activities included supporting the decision-making process, preparation of plans for Project direction, setting goals for Project activities, measuring progress within the Project, and the development and maintenance of analytical models.