

ARCO SOLAR, INCORPORATED THE INDUSTRIAL POINT OF VIEW

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Sawed slices for use in the solar cell industry maybe reaching their zenith during the next two years or.....

Sawed ADVANCEDCZ and SEMIX or SILSO wafers continue to dominate the photovoltaic electric business for the last ten years.

The photovoltaic electric market has progressed due to present multimegawatt per year status in a short time. It has become a rapidly growing business by making slices sawed with ID saws and grown from semiconductor silicon.

ADVANCED CZ

Rapid improvements in the size, speed and automation of CZ growers have been made since 1979. ARCO Solar regularly uses JPL developed recharge equipment for multiple crucible pulls. Proprietary modifications to growers have dramatically increased average pull speeds. Microprocessor control systems assure repeatability and minimize training requirements. Making CZ ingots in production is now a very fast, simple task.

POLYCRYSTALLINE BLOCKS

Work done in Germany by Wacker Chemie and in the USA by Solarex have developed pilot production casting systems for manufacturing large grain polycrystalline blocks, casting the block in a square mold partially offset the lower average solar cell efficiency and wider variation of yield now experienced by these materials.

ARCO Solar was the first company in the USA to receive the processed SILSO material from Germany in late 1976. Meetings with Task II personnel at JPL cast doubt on the commercial promise of this concept. Fortunately, the Germans were not stopped by these opinions and neither were the Hungarians.

In the last three years, ARCO Solar has processed several tons of POLYCRYSTALLINE SILSO blocks and has a production ready

process. The blocks, however, still cost over twice that of in house CZ ingots. Our cost estimates consider direct labor material, overhead and the fact that ARCO Solar CZ cells AVERAGE over 14% AM 1 efficiency without antireflection coating. Wacker Heliotronic is installing a larger pilot casting and machines and Solarex is continuing to develop SEMIX production. Both systems are improving, but, so is ADVANCED CZ.

Sharp Corporation in Japan has recently come on-stream with a four inch CZ module with sizeable production capability. The market during 1982-83 will prove very competitive.

LOWER COST SAWED WAFERS

Very simple and are now proprietary at least ten to twenty megawatts of production capacity between CZ and the cast-block producers. The obvious minimum risk most predictable cost reductions are:

- A. Low cost polysilicon to make the wafer materials cost less making curf loss less important.
- B. Better saws capable of sawing larger ingots and blocks reliably with more slices per inch.(less curf, etc.)

Item A has been discussed at other meetings and is underway by several commercial companies including ARCO Solar.

Item B as reported to me and from my own experiences, is still a "Non Event."

ID SAWS

ID saws are getting larger with 27" and 32" proposed (more diamonds). These saws will require less blade changes and saw bigger wafers (more watts per minute). Revolutionary efforts, such as rotating ingots at Siltec went down in flames.

WIRE SAWS

Crystal Systems has not been able to demonstrate production feasibility under JPL funding, but, there is hope. Motorola was rumored to have wire saw technology that is a proprietary company secret?? Solarex tested a Japanese wire saw with poor results.

BLADES

Varian Associates had a good contract from JPL but forgot

there was a real commercial market for their product. Management did not continue funding their project, hence, technical problems were not over powered. Reports from Switzerland indicate the Meyerberger efforts have not met the speed/productivity goals set, even when a larger curf allowed.

NEW STARTS

Flat-lining or cutting back the DOE program plus emphasis on "Thin-Film" or "Ribbon" breakthroughs have cast sawing technology into a scrap heap. Our minds are in neutral. I would guess the right people to solve this problem may not even be at this conference.

If you don't devise and develop a fast, reliable production saw, then history can record that:

After developing the industry into a multimegawatt position from 1973-83, solar wafer growing or casting and sawing remain a technique for the semiconductor industry. The solar cell industry abandoned these techniques for:

- A. Silicon ribbon
- B. Various thin films

If you view this as inevitable, then, that is what will happen. If you believe you have a better idea, let industry know about it.

Your better idea can lengthen the productive life of at least 100 million dollars worth of investment.

Discussing the latter view is the purpose of this meeting.