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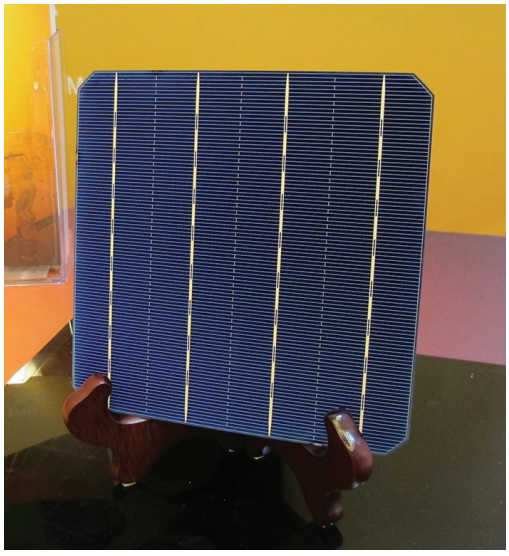
PERC UP

Next-generation solar modules promise new opportunities

by Eric Ma



THE SOLAR INDUSTRY IS BOOMING. THE SOLAR ENERGY INDUSTRIES Association (SEIA) reports that 1,655 MW of new solar systems were installed in Q1 of 2016, up 24% over last year. Solar accounted for 64% of all new electrical capacity in the first quarter. Residential solar sales remain relatively flat, though first time non-residential PV sales showed a 300MW rise in back-to-back quarters. Sales seem to be moving from residential to commercial and utilities, but that doesn't mean residential sales are going to remain flat. Emerging Passive Emitter Rear Contact (PERC) PV technology will change that.

PERC solar modules are the next generation in solar technology. They can increase conventional solar cell efficiency by 1% of the absolute value, delivering 10 more wattage in a smaller PV module footprint, and offer new potential applications. Consider, for example, how much more power a solar array can deliver using the same footprint on a multi-tenant building or office building. More efficient solar panels also can make PV systems more cost-effective in snow belt markets that receive less regular sunshine.

Although PERC technology has been with us for a few years, the challenge to date has been bringing manufacturing costs down to make PERC cost competitive with conventional solar panels. Changes in manufacturing processes and new production techniques currently make PERC panels highly competitive for new solar applications.

The PERC power advantage

PERC technology is able to generate 5% more power by improving solar energy production and volume. It makes better use of available light, providing better electron flow to produce more electricity with more efficiency.

Like conventional solar cells, PERC can be applied to both monocrystalline wafers and multicrystalline-based PV technology, but PERC adds a dielectric passivation layer at the rear of the solar cell. This extra dielectric passivation layer reduces electronic recombination and allows electrons to flow more freely.

In addition, PERC cells reflect less light. Opening the rear passivation stack using chemicals or lasers creates tiny pockets which capture more light. Higher internal light reflectivity increases efficiency.

The largest impediment to PERC adoption has been production costs. The average p-type monocrystalline PERC cell is about 150% the cost of standard p-type multicrystalline cells, yet the power efficiency of PERC cells is 15% higher than standard multi cells, and 7% higher than standard mono cells. In the lab, p-type mono PERC cells claim a 19.89 - 20.4% increase in efficiency, and standard p-type multi cells a 17.2 to 17.8% improved efficiency. However, to date, the cost of production has made standard cells more attractive.

With the advancement of the equipment R&D, the PERC technology can be implemented in a traditional cell processing line at a fraction of the previous investment. Further, by successfully integrating the PERC into the existing cell lines of the manufacturers, the manufacturing cost increase could be kept to a minimum.

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More manufacturers are migrating to n-type Cz-Si wafers over p-type mc-Si wafers for high-efficiency panels; n-type delivers >25% efficiency, while p-type delivers >22% efficiency. More importantly, n-type wafers bring three additional characteristics to PV cell manufacturing:

1. Most n-type cells use phosphorous where p-type wafers use boron. Due to the absence of boron there is no light induced degradation in n-type Si wafers.
2. In general, n-type wafers are less sensitive to metallic impurities in silicon feedstock, which means they can use less expensive substrates.
3. n-type Si is less prone to degradation in high-temperature processes.

As a result, combining PERC with n-type cell technology results in lower LCOE.

It's easy to retool for PERC

Market conditions are causing more PV panel manufacturers to rethink their strategy and retool their factories. Industry experts predict that PERC cell production will exceed 15GW in 2017, which means that solar cell production is moving towards PERC. In 2017, p-type PERC solar cells are expected to make up 20% of all solar cell production.

For manufacturers looking to upgrade their cell production lines, PERC offers an easy alternative for rapid production expansion. Converting to manufacture PERC cells from standard cells requires few new processes, such as adding laser tools for contact openings.

In addition, as the market glut for conventional solar cells continues, shifting to PERC production will serve to differentiate solar module products. Furthermore, as prices start to decline, maintaining tight control over production costs and product quality will become as important as manufacturing higher efficiency solar cells.

PERC offers new possibilities

The race for PERC not only helps manufacturers differentiate their products with a solar cell that delivers more power in a smaller form factor, it also gives designers and developers more freedom. With PERC, they can install solar in unorthodox spaces and smaller areas that were previously impractical for solar. And the higher energy density of PERC panels delivers more power per square foot, making them ideal for low light and high temperature applications. When considering total energy production rather than peak wattage, PERC is clearly a winner.

PERC also helps drive down Balance of System (BoS) costs. The ability to produce more energy with less has a trickledown effect that reduces soft costs, which may be enough to minimize sticker shock on new projects.

As solar cell manufacturing becomes more efficient and more competitive, PERC will become more economical for new installations. More manufacturers will make the minimal investment needed to retool for PERC, and market leaders will go one step further to manufacture n-type PERC modules for even greater efficiency.

Eric Ma is the president of Boviet Solar, USA.

Boviet Solar | www.bovietsolarusa.com