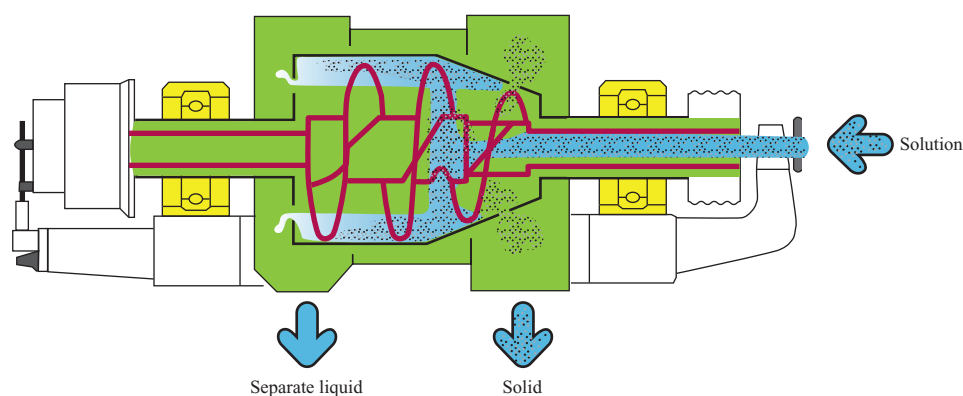


Challenging the Global Market with Centrifugal Separation Technologies

Wire Saw Slurry Recycling System, which has a 90% share in the Japanese market, realizes solar cell cost reductions.

While power generation technologies using natural energy have recently been attracting attention, in reality their power generation costs remain high. Our Wire Saw Slurry Recycling System (WSRS) is playing a role in reducing solar cell manufacturing costs as well as the environmental burden of solar technologies.



Principle of the screw decanter centrifuge

Environmental problems have become major global issues and solar cell production volume has been increasing dramatically in recent years because photovoltaic generation systems advantageously reduce peak power demand during the day as well as reduce the greenhouse gas emissions. This industry is expected to grow as part of the shift toward a low-carbon society. To further expand the market for photovoltaic generation systems, the efficiency of the solar cells used to convert sunlight to electricity must be improved and manufacturing costs must be reduced.

In one type of solar cell manufacturing process, ingots of crystalline silicon produced from silica are sliced to a thickness of 0.1 mm by using a thin wire running at a high speed in a device known as a wire saw. In this process, the ingots are sliced while an abrasant fluid is poured onto the wire saw. The fluid is a mixture of silicon carbide and other abrasive grains with a liquid (coolant) that absorbs

and disperses the heat generated by slicing. This slicing technique is known as the free-abrasive machining method. The process consumes a large amount of abrasant fluid, which accounts for the highest percentage of the cost. IHI Compressor and Machinery Co., Ltd. (ICM) focused on this point and started development of an abrasant recycling technology early on.

Slicing generates slurry composed of crystalline silicon swarf, abrasive grains, and coolant. The necessary amount of new abrasant fluid can be reduced by establishing a technology for separating, collecting, and reusing the slurry for slicing. If such a system is able to collect materials highly efficiently, it will also reduce waste and be an environmentally-friendly system.

ICM aimed to realize such a Wire Saw Slurry Recycling System (WSRS).

Slurry recycling technology

WSRS adopts a 2-stage separation method by using a combination of two screw decanter centrifuges, which are high-speed rotation devices, arranged in series. In the first stage, abrasive grains and coolant are separated and collected. In the second stage, the coolant collected in the first stage is put through the centrifuges again and separated into waste sludge and clean coolant.

New abrasive grains and coolant are added to the abrasive grains collected in the first stage and the coolant collected in the second stage and then fed to the wire saw as recycled abradant fluid.

The collection rate for abrasive grains is approximately 95% and that for coolant is approximately 90%. The silicon removal rate is approximately 60%.

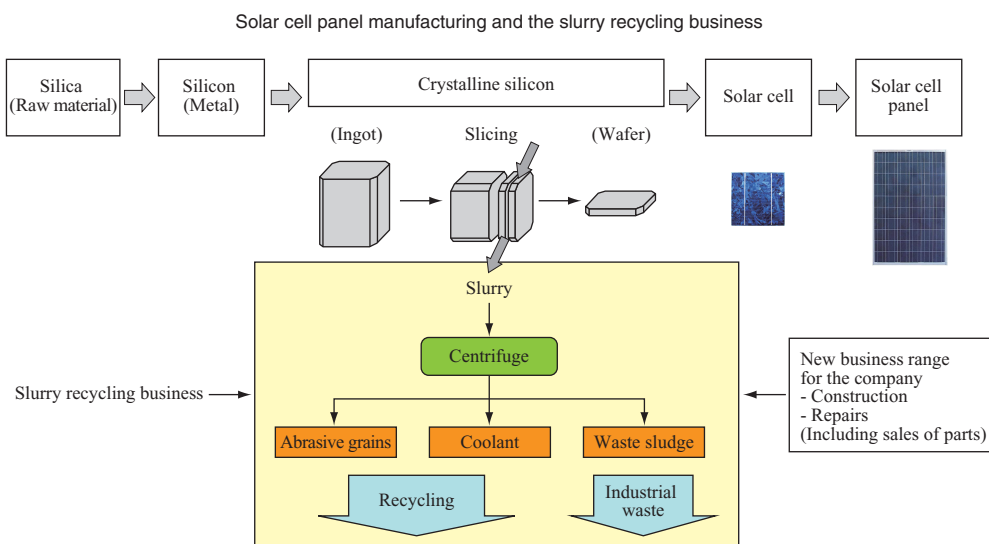
ICM has a share of more than 90% in the Japanese market for slurry recycling systems using centrifugal separation technologies.

Expansion to overseas markets

In addition to the free-abrasive machining method, the diamond wire sawing process is also used to slice silicon. The diamond wire sawing process slices silicon by using a wire saw to which diamond powder has been welded or otherwise affixed and pouring only coolant. Though its slicing speed is low, the free-abrasive machining method can slice both hard monocrystalline silicon and fragile polycrystalline silicon, dramatically reducing the cost of WSRS. On the other hand, the diamond wire sawing process can slice silicon at higher speeds but can only be used for hard monocrystalline silicon.

An examination of the types of solar cells manufactured around the world reveals that in Japan, where solar cells are primarily for residential use, monocrystalline silicon solar cells are generally used, which generate larger amounts of electricity per unit area, though their production cost is relatively high. However, in foreign countries where large sunlit areas are available and solar cell power generation facilities can be installed in a variety of places, polycrystalline silicon solar cells are generally used, which can be manufactured at lower costs though their conversion efficiency is less than that of monocrystalline silicon solar cells.

As mentioned previously, the free-abrasive machining method is used primarily for slicing silicon, which means



Slurry business

that the maximum benefits of WSRS are achieved by applying it to solar cell manufacturing lines overseas.

ICM's WSRS has been adopted by solar cell manufacturers in Taiwan, China, Malaysia, the United States, the Philippines, and other countries. WSRS is appreciated by customers for its contributions to reducing solar cell manufacturing costs.

Future developments

We will improve the collection efficiency of abrasive grains and coolant for the free-abrasive machining method used overseas in addition to accumulating experience in expanding the market of large-scale recycling systems.

We cannot overlook the rise of the diamond wire sawing process. We are also developing a recycling technology for this process and have already reached the stage of practical application tests. We plan to launch this technology into the market in the near future.

To respond to the accelerated globalization of the market and the trend of rapidly increasing deliveries to our overseas customers, the need to establish overseas field service bases and improve customer satisfaction is growing.

In addition to providing recycling technologies and systems, we aim to provide comprehensive services ranging from main unit assembly to incidental work and delivery, enhance after-sales services, and quickly respond to our customers. As a first step toward this goal, we established IHI System Technology Taiwan Co., Ltd. (ISTT) in Taiwan in January 2011 to reflect customer demands in our products and further accelerate development.

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