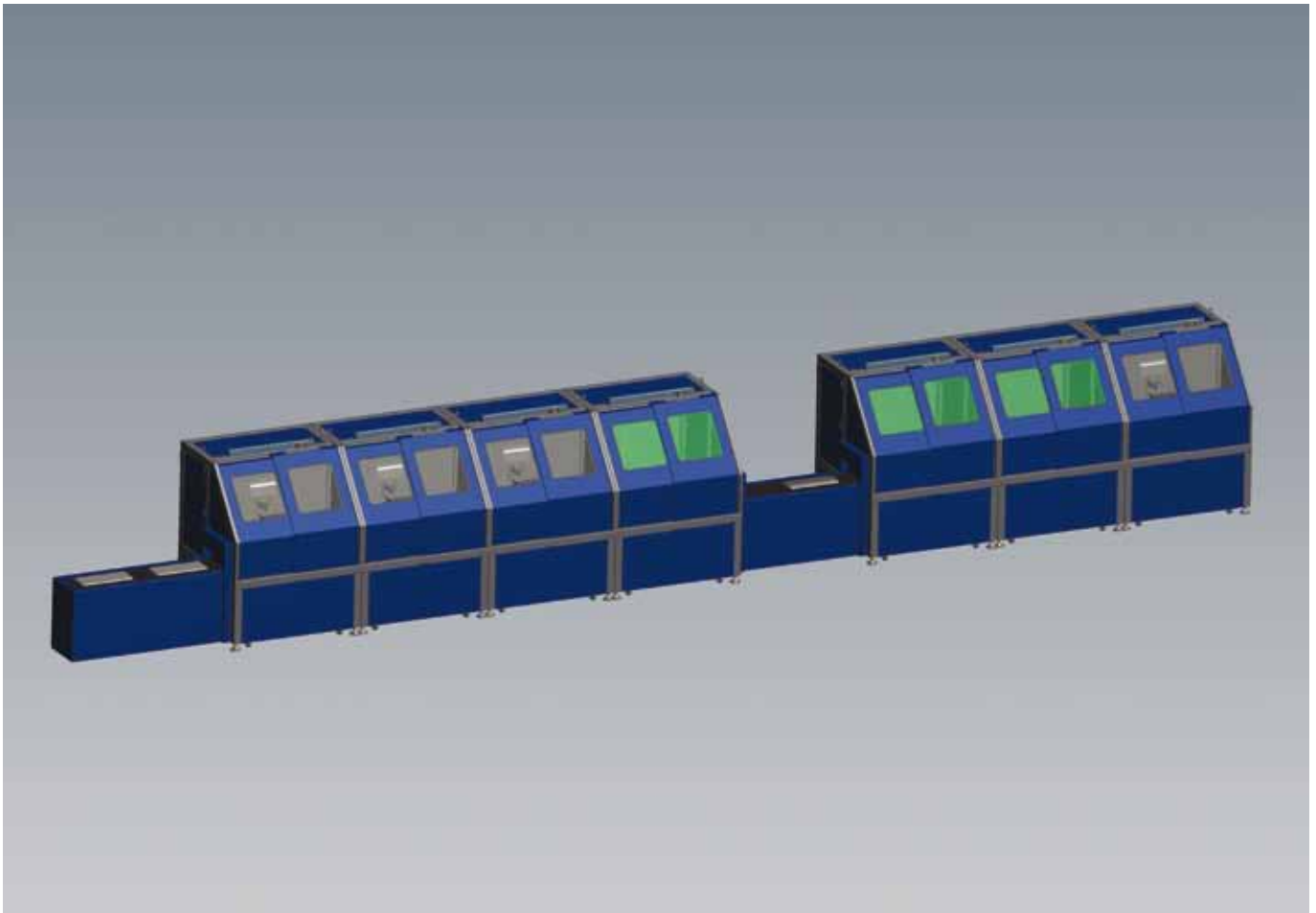


Artech's sidecut recycling line for polycrystalline ingots helps you cut costs and improve process quality.

Ingot sidecuts will always contain carbides. How large these carbides are and how they are distributed throughout the ingot can tell you a lot about how effective your process is. Our solution provides you with the following:

- Scanned sidecuts where carbides have been removed
- Intact sidecut portions which are cut to the optimal size for the crucible
- An analysis of each side cut, and a generated alarm when there is a risk of impure material entering production.



Artech sidecut recycling

Carbides

Carbides come in different sizes and numbers. The top portion of the sidecut will always contain the most carbides. The rest of the sidecut can successfully be reused if the carbides are removed.

Larger carbide inclusions are not desirable, and there is also the risk that they appear in blocks.

Smaller inclusions will appear in greater or lesser quantities in most ingots and need to be removed.

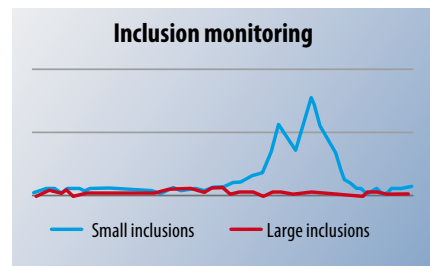


Example of a larger inclusion.

Instant detection

The carbide distribution in the sidecuts is a symptom of the quality that can be expected in the silicon blocks.

Monitoring these carbides can give important feedback to the production process.



Carbide removal

Artech's sidecut recycling removes the carbides before the sidecuts are used to line the casting crucible walls. They are cut to an appropriate size to make it easy to place it in the crucible.

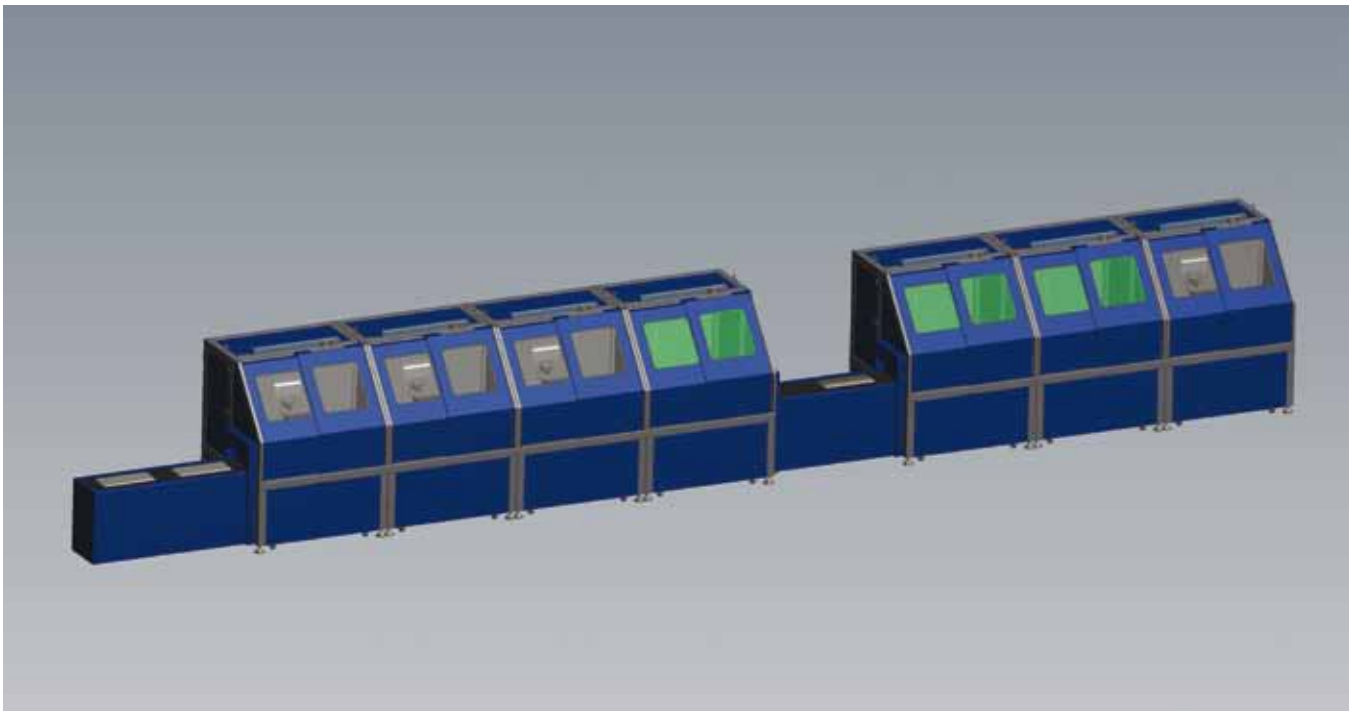
Knowing that the side plates are free of carbides, increases the value of the side cut, and helps cut costs and improve quality.

Artech sidecut recycling

The sidecut recycling process

Each step in the sidecut recycling process is developed to provide the maximum of information, as well as ensuring optimum process stability. Each step can be adapted to the customer's specific needs.

- First the most polluted areas are removed. The amount of material to be removed is calculated in each case, normally the top and the first few millimeters of the crucible-facing outer-surface.
- The entire sidecut length is cut into optimal-sized pieces. Normally these pieces are cut in order to fill the entire crucible wall perfectly.
- The sidecut pieces are then surface-cleaned.
- The sidecut pieces are scanned and carbides identified. Any carbides found are then removed.



Process data

Footprint	G4	G5	G6
No. of ingots (4 sideplates) per hour	6,2	5,3	4,6
Estimated tool costs (US \$) per ingot	7	8,6	10,2
Estimated number of operators	1	1	1

Artech sidecut recycling

Full traceability and analysis

Each side-plate is registered (several ways are possible) and the analyzed. The analysis data is then stored for traceability purposes and for use in statistical analysis.

Typical data that is stored for each sidecut includes:

- Number of carbides, their location and size
- Image of the side plate
- Image of the side plate after impurities are removed



Bar code to identify side cut.

Profitability

The value of sidecuts can be viewed from different perspectives. From a material point of view they are worth less than polycrystalline silicon, except that they have a shape which is attractive for protecting the walls of the crucible.

When impurities are removed, however, the sidecut value is high. It has an attractive shape which reduces damage to the crucible coating layer. When free of carbides, it has a better quality than polycrystalline silicon.

Artech's sidecut recycling process removes the carbides before the sidecut pieces are used to protect the crucible wall. They are cut to the appropriate size to make it easy to place in the crucible.

Knowing that the side plates are without carbides, increases the value of the side cut, and helps cut costs and improve quality.

An automatic sidecut recycling solution is a very profitable investment and provides low cost raw material that can be used to protect the crucible. The removal of carbides also yields improved wafer quality due to fewer impurities entering production.