**TUBE FILAMENTS**

**Improves All Aspects of Any CVD Process**

GT Advanced Technologies’ patented Tube Filaments are a revolutionary new technology for the polysilicon industry that can be applied to any Siemens CVD reactor. Using Tube Filaments in place of standard filaments not only creates drastic improvements in productivity and energy consumption but also virtually eliminates small diameter aborts and large diameter tip overs. GT Advanced Technologies manufactures and sells Tube Filaments directly to polysilicon producers allowing for multi-dollar per kilogram savings to be obtained with absolutely no capital expense.

<table>
<thead>
<tr>
<th>CAPEX Requirement</th>
<th>Capacity Improvement</th>
<th>Electricity Consumption</th>
<th>Process Aborts</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>30% - 75%</td>
<td>20% Improvement</td>
<td>Reduced 75%</td>
<td>&gt; 100 Ω-CM</td>
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</tbody>
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 Silicon filaments are essential to polysilicon production. Pairs of filaments are each connected by a silicon bridge to form a U-shape. When loaded into a reactor, these U-shaped rods become the surface material for the trichlorosilane decomposition process that produces polysilicon. GT’s Tube Filaments shorten this process resulting in increased production capacity and lower energy costs.

**> 30% Capacity Increase and 20% Reduction in Electricity Use**

The unique design of GT’s Tube Filaments maximizes the surface area available for silicon growth from the very start of the deposition cycle. This lets the CVD run efficiently at high production rates from the very beginning of its batch and eliminates the many hours of inefficiency created by standard filaments. These shortened, highly productive, deposition cycles result in increased production capacity of at least 30% and a 20% reduction in electricity consumption when using the same length filaments and growing to the same final rod diameter as standard operations. The stable robust design of Tube Filaments also enables the use of tall filaments and bigger final rod diameters. Leveraging all the benefits Tube Filaments provide capacity improvements upwards of 75% are possible in existing CVD production equipment.
TUBE FILAMENTS

Improved CVD Reliability – No More Tip Overs

The stiff geometry, wide footprint, and strong bridge connection created by Tube Filaments make early run aborts a thing of the past. These attributes allow CVD process conditions to be optimized for production instead of being concerned with run success. The hollow design of Tube Filaments enhances reliability at the end of the run by allowing for large rod diameters without risk of melting and eliminating the rod stress which causes tip overs during cool down. Process reliability is an important financial and quality metric which Tube Filaments address better than any other technology.

Free Capacity Increase and Reduced Plant CAPEX

With large scale Tube Filament manufacturing located in Asia, GT Advanced Technologies offers Tube Filaments for sale to polysilicon producers in commercially required volumes. Our proprietary manufacturing technology ensures the lowest cost and highest quality possible for our customers and our Asian manufacturing infrastructure ensures a highly reliable and efficient supply chain. Offered as a consumable, Tube Filaments provide immediate benefits to CVD operations with no capital outlays.

Tube Filament Technology Designed and Developed by GT

GT Advanced Technologies parts and equipment are used in manufacturing the world’s most efficiently produced polysilicon. As one of the largest equipment suppliers for creating polysilicon, our industry-leading expertise focuses on the highest value process steps and our internationally patented Tube Filaments are the perfect embodiment of this mission. The result of years of development and testing, Tube Filaments proudly deliver multi dollar/kilogram reduction in COGS without requiring equipment modifications or capital expenditure.

Key Technology Benefits

- > 30% capacity increase
- > 20% power consumption reduction
- Usable in GT’s CVD reactors as well as all other brands
- Stable hairpin design allows for use of tall filaments
- Eliminates melt out in larger diameter rods
- Eliminates stresses that cause standing rod breakage
- No power supply modifications needed
- No CAPEX required

About GT Advanced Technologies

GT Advanced Technologies is a diversified technology company producing innovative crystal growth equipment for the solar PV and power electronics industries, and sapphire material for precision optics and other specialty industries. The company’s technical innovations accelerate the use of advanced materials, enabling a new generation of products across this diversified set of global markets.

Learn more at www.GTAT.com