SPS-DC Power Supply

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CVD Reactor Requirements

The Chemical Vapour Deposition (CVD) Reactor is the most diffused technology for production of extra-pure PolySilicon both Electronic and Solar Grade. During the deposition process Pure Trichlorosilane or Silane gas (injected in the Reactor) deposits on Pure Silicon Filaments, which are continuously heated by means of AC or DC current, to get the desired Polysilicon. The finest is the Filament Temperature Regulation, the highest are the Poly-Si Production Rate and Quality; the Temperature Regulation is directly proportional to the Regulation of the Current Supplied to the Filaments.

Therefore the Current Regulation of a Power Supply for CVD Reactors must be both Accurate on an extremely wide range and Fast and Reliable.

In order to increase the Production Rate CVD Reactors of the last generation are provided with a higher number of rods resulting in an increased request for flexibility of the Power Supply System. FRIEM has replied with the SPS-DC Line, which thanks to its modular design perfectly meets the flexibility and load independency required.

CVD Reactor

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The main characteristics today required to Power Supply for the maximum production capacity are:

- Load supply independency: highest efficiency of the process with the independent control of the different parts of the Reactor;
- Flexible electrical supply in order to always match with the process requirements: a batch process is varying time by time (up to 20% difference from one cycle to another);
- Fast regulation response: smooth control of the process and good electrical performances.

SPS-DC is the only Poly-Si Power Supply based on the use of IGBT DC/DC Converters. The whole system is constituted by:

- Rectifier Transformer
- Main Control Panel
- Start Choppers
- Run Choppers
- Pre-Start Unit

FRIEM supplies also:

- Load Switching System
- Earth Switching System
- Busbar System Design and Supply
- MV Switchgear
- DCS Design and Communication with the SPS Main Control

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- **Higher Production Continuity** granted by the Independent Load Supply
- **Constant Electrical Performances** for all the Different Processes
- **Full Control and Protection** of each Hairpin
- **Higher MV Network Dips Withstand Capability**

**Electrical System Benefits:**
- **Power Factor > 0,947** and CONSTANT through ALL the Process
- **Low Harmonic content** and CONSTANT through ALL the Process
- **NO Medium Voltage Phases Unbalance**
- **Complying with IEC and IEEE Standards** even WITHOUT Capacitor Banks and/or Harmonic Filters

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**CVD Reactor Requirements**

The Chemical Vapour Deposition (CVD) Reactor is the most diffused technology for production of extra-pure PolySilicon both for Electronic and Solar Grade. During the deposition process Pure Trichlorosilane or Silane gas (injected in the Reactor) deposits on Pure Silicon Filaments, which are continuously heated up to more than 1000°C continuous temperature that must be reached at a rate of 1,000°C per hour and then kept constant at 900°C. The Temperature Regulation is directly proportional to the Temperature of the Current Supplied to the Filaments. Being the Temperature Regulation of a Power Supply for CVD Reactors must be based on an extremely wide-range Functionality and Control.
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The term of the FRIEM Power Converters design is the Poly-Silicon Power Supply. The Temperature Regulation is strictly proportional to the regulation of the Current Supply in the 20 V-I curves.

CVD Reactor

Power
Supplied
CVD Reactor
Polysilicon deposition
Inlet gases
Waste gases
Run phase = Main Deposition
Start phase = Deposition
Pre-Start phase = Filament conduction
Current - Time Voltage
V-I Curve of the Process

SPS-DC Power Supply

SPS-DC Line

Power Supply System

Power Electronics & Automation

FRIEM S.p.A. - Via Edison, 1
20090 Segrate - Milano - Italy
Phone: +39 02 213 33 41  Fax: +39 02 26 92 30 36
Internet: www.friem.com  E-mail: sales@friem.com
ISO 9001-2000 STANDARD
**Pre-Start**

**General Characteristics**

The Pre-Start SMC-S is a series of offering fully integrated, in all stages of the process, the system continuously monitors all the functions, allowing real-time control and adjustment.

**Remote SPS Supervision**

Customer set up in a complete package, including in the SPS those accessories like: Start Choppers and the Pre-Start can supply other filaments.

**The Silicon filament**

From the highest flexibility and continuity of the Production, therefore the greatest production capacity.

**Operating Characteristics**

Customer set up in a complete package, including in the SPS those accessories like: Start Choppers and the Pre-Start can supply other filaments.

Thyristor Bridge

For the Thyristor Bridge, the most suitable for the process, allows the deposition process to continue in case of fault.

**Start Chopper**

**General Characteristics**

Each SMC is equipped with a Main Control Panel. The SMC-245 is a full-range and powerful Control System and Panel Instrumentation on the SMC, previously known as the process.

**Operating Characteristics**

The SMC is equipped with a Touch Screen HMI showing all the functions, allowing real-time control and adjustment.

**Rectifier Transformer**

**General Characteristics**

The Rectifier Transformer is able to provide a clean DC output voltage, required for the process, allowing real-time control and adjustment.

**Protection and Measurements**

All the components of the SMC are designed to protect the apparatus and the system continuously monitors all the functions, allowing real-time control and adjustment.

**Main Control Panel**

The Main Control Panel, the system continuously monitors all the functions, allowing real-time control and adjustment.

**Run Chopper**

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