

Presentation



Sustainable Energy in Central Asia: Business Opportunities and Technology Transfer

6 November 2014

Brussels, Charlemagne Building, Room Mansholt

Semco Engineering: Developing Solar Technology in Kazakhstan

by Krister Olsson Project Manager

Corporate Presentation
2014

SEMCO ENGINEERING

Products & Services for the Photovoltaic Industry



SEMCO Engineering Group

Key Data

Business	Industrial Equipment, Engineering, Process
Sector	Photovoltaic and semiconductor materials
Legal Form	Limited Company with Supervisory Board
Foundation	1986
Capital	5 millions Euro
Structure	Founder/Employees/Private Equity (60/20/20)
Employees	145 (2013)
Turnover	40 millions Euro (2013)
R&D Share	Approximately 10% of turnover
Export Share	More than 90% of turnover
Industrial Property	12 patent families and 3 international protected trademarks
PV Cell Fab	10-MWp production + LabFab new cells
Turnkey fabrication lines	Yes, including integration services
Service Network	Global Worldwide

Business Units



Industrial Equipment for the c-Si processing

- N & P-type doping
- Dry and Wet Oxidation
- Plasma Enhanced CVD
- Dry Texturization
- Automated transport of Silicon wafers.
- Process supervision
- Application Laboratory
- Process Physicochemistry



PV Cell Manufacturing Fabrication Laboratory

- 24/7 working
- Multicrystalline PV Cells
- Monocrystalline PV Cells
- N-type PERT Cells
- Process qualification
- PV Foundry
- Outsourced Industrial R&D
- Training Center
- PV Materials Qualification



Vertically-integrated PV Manufacturing Plant

- Wafers, Cells & Modules
- Project Management
- Engineering, Procurement
- Commissioning
- Staff Training
- Technology Transfer
- Process Guarantee
- *3BB monofacial*
- *N-type bifacial*

A Global Worldwide Presence



Some References

- Photovoltaic Industry / Mono and Multi c-Si from Wafering to PV Modules



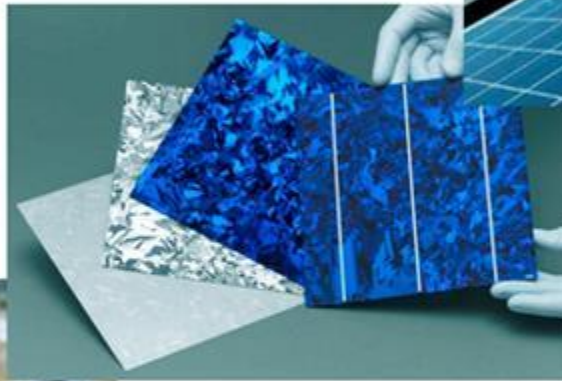
- R&D / Casting, purification / PERT, n-type bifacial technologies



Creating a National Solar Industry



MODULE → SYSTEM



WAFER → CELL



Creation of a National Photovoltaic Industry



PV Modules & Systems



PV Wafers & Cells



Quartz Mine



Feedstock
& Purification



Universities

Material before Purification (09-Dec-11)



- Excellent quality of QUARTZ™ material

- B: 1.3 ppmw
- Al: 45 ppmw
- P: 1.2 ppmw
- Fe: 7 ppmw



- Silicon Metal KazSi

- B: 15.8 ppmw
- Al: 400 ppmw
- P: 7.2 ppmw
- Fe: 650 ppmw

- Si Mg SEMCO

- B: < 3 ppmw
- Al: 800 ppmw
- P: 8 ppmw
- Fe: 650 ppmw

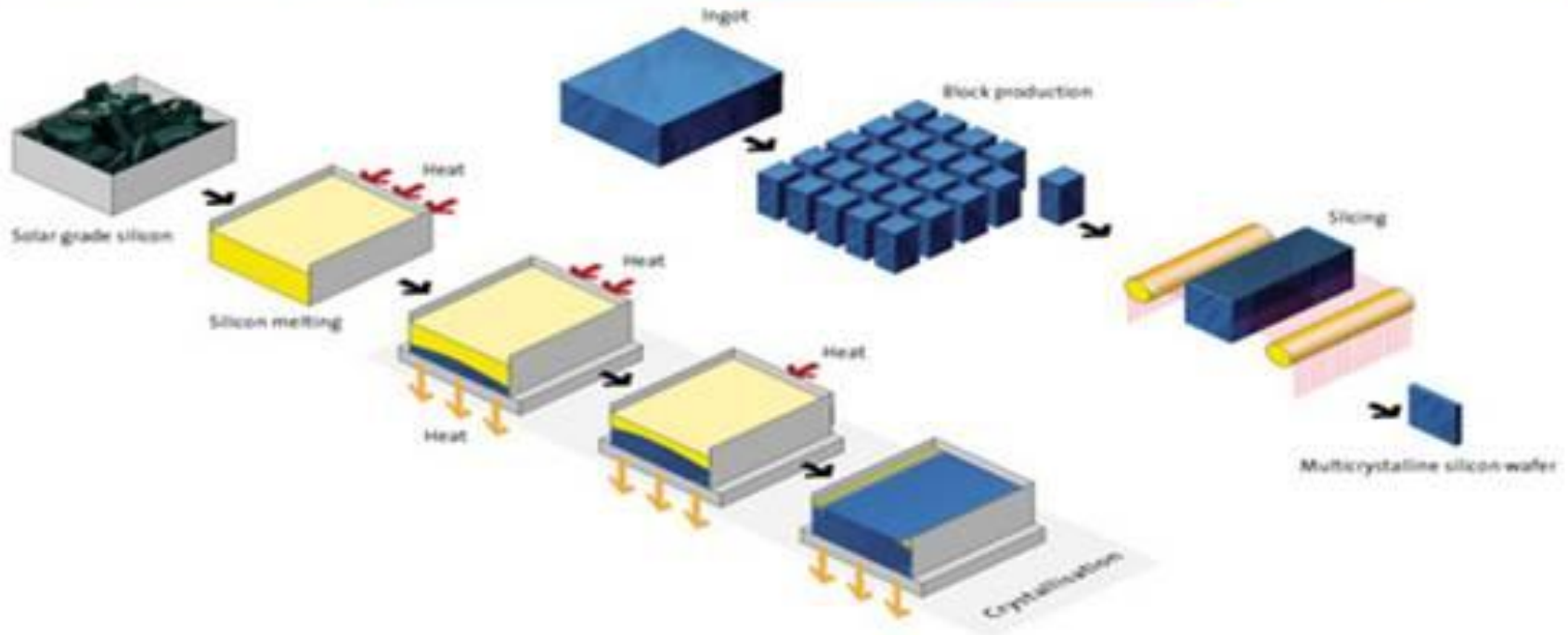
KazSilicon at SEMCO

Contract signed 09/2011 First delivery 05/2012



KazSilicon at SEMCO

05/2012



Wafering Composition



Ingot D0106S01
13.07.2012

SOG Silicon provided by SEMCO, presented as blocks, and then etched (KOH-based) to clean the surface of the pieces. The blocks were additionally half-cut before the charge. No dopant was added.



PV Cell Manufacturing

08/2012



Module Manufacturing in Spain

09/2012



Module Shipment to Astana

09/2012



Module Roof Astana Solar (1)

11/10/2012



Module Roof Astana Solar (2)

25/10/2012



Astana Solar Plant

25/12/2012

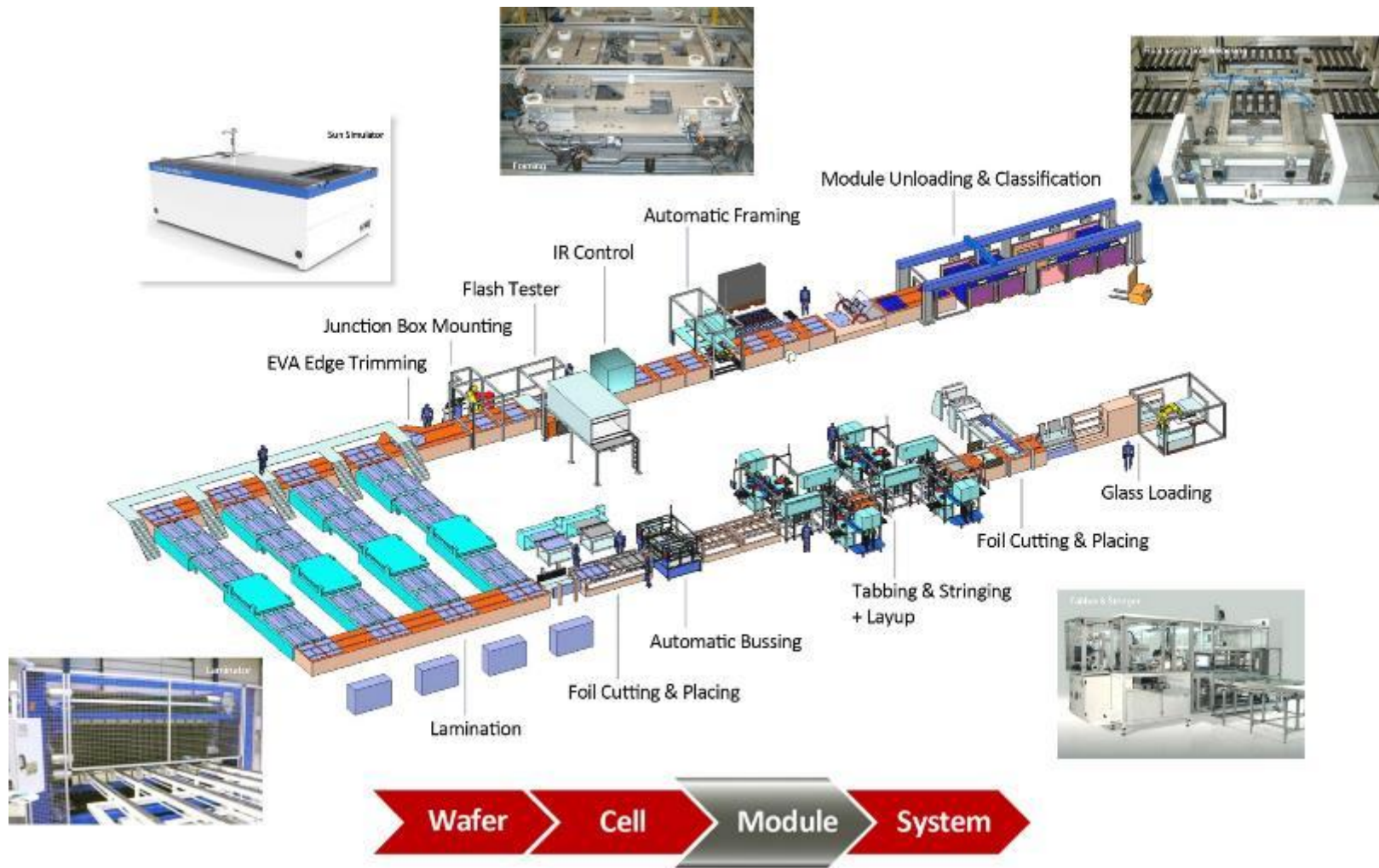


PV Module Production Line *Astana Solar*



PV Module Production Line

Astana Solar



Factory Engineering *Kazakhstan Solar Silicon (KSS)*



PV Cell Production Line

Kazakhstan Solar Silicon (KSS)



PV Cell Production Line

Kazakhstan Solar Silicon (KSS)



KSS PV Cell Production Line

Texturing



KSS PV Cell Production Line

Diffusion



KSS PV Cell Production Line

PECVD



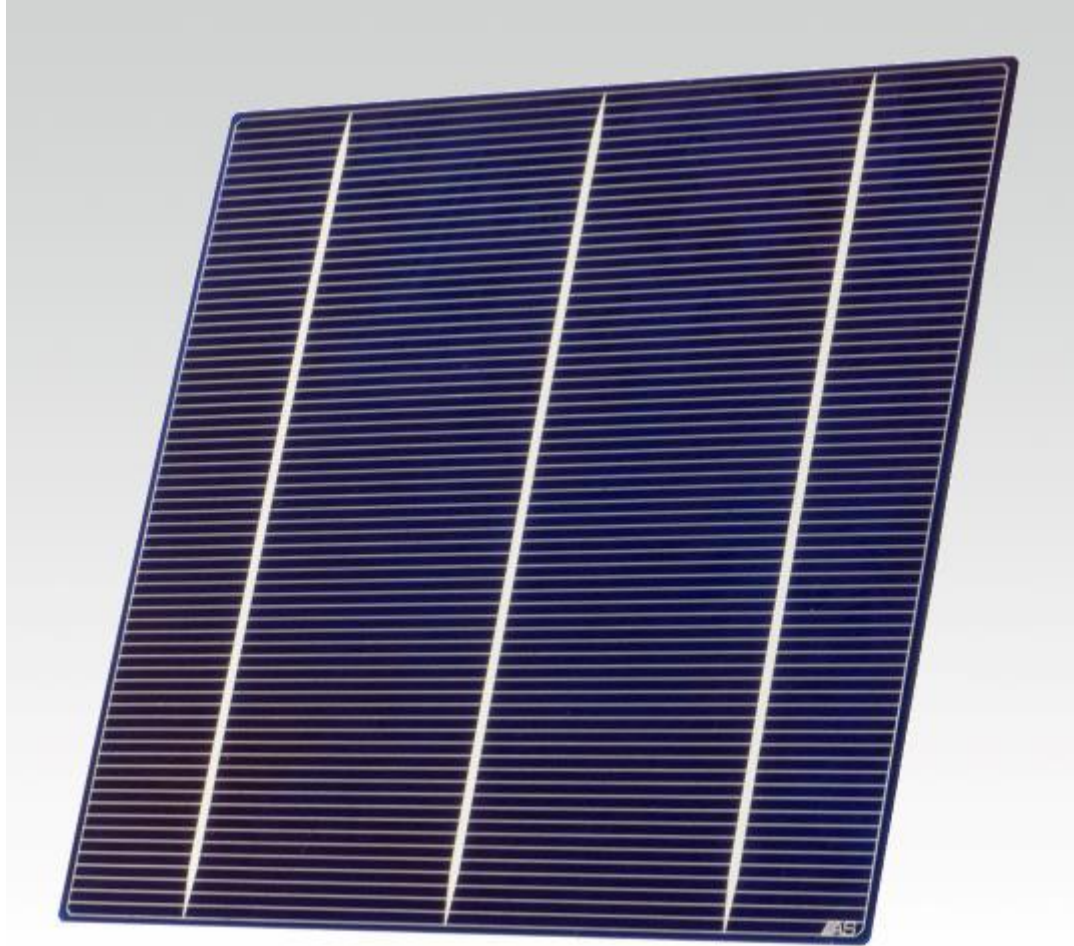
PV Cell Production Line Sorter





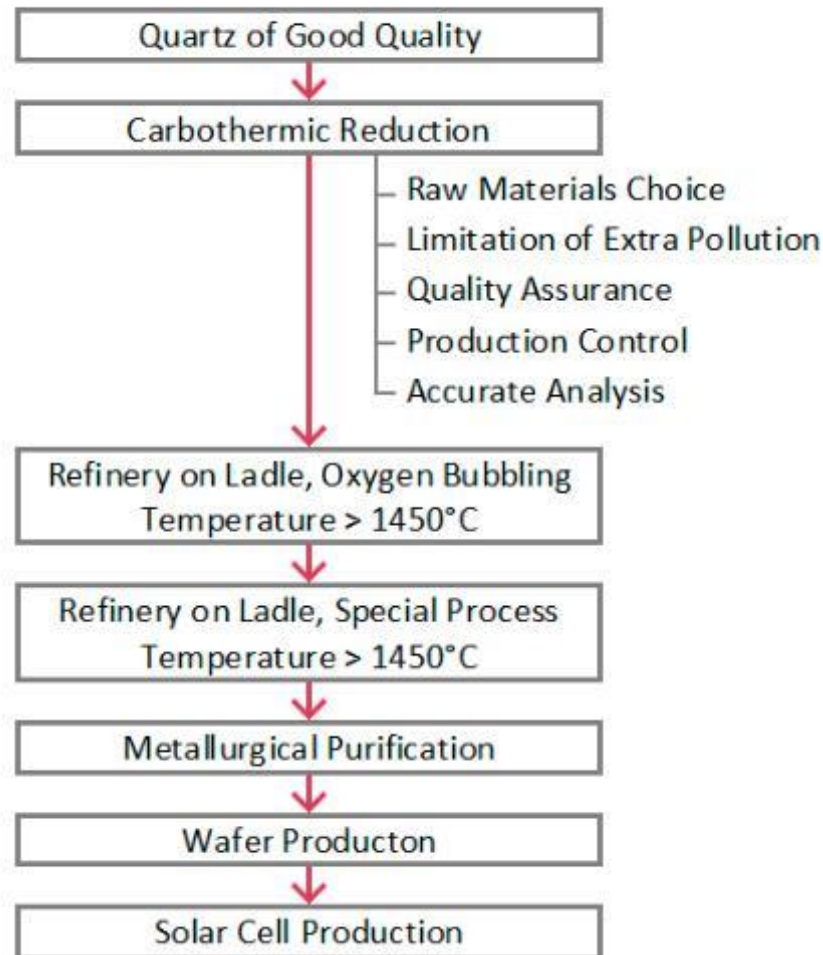
KSS PV Cell Production Line

PV Cell



Production of Solar Grade Silicon

METALLURGICAL ROUTE

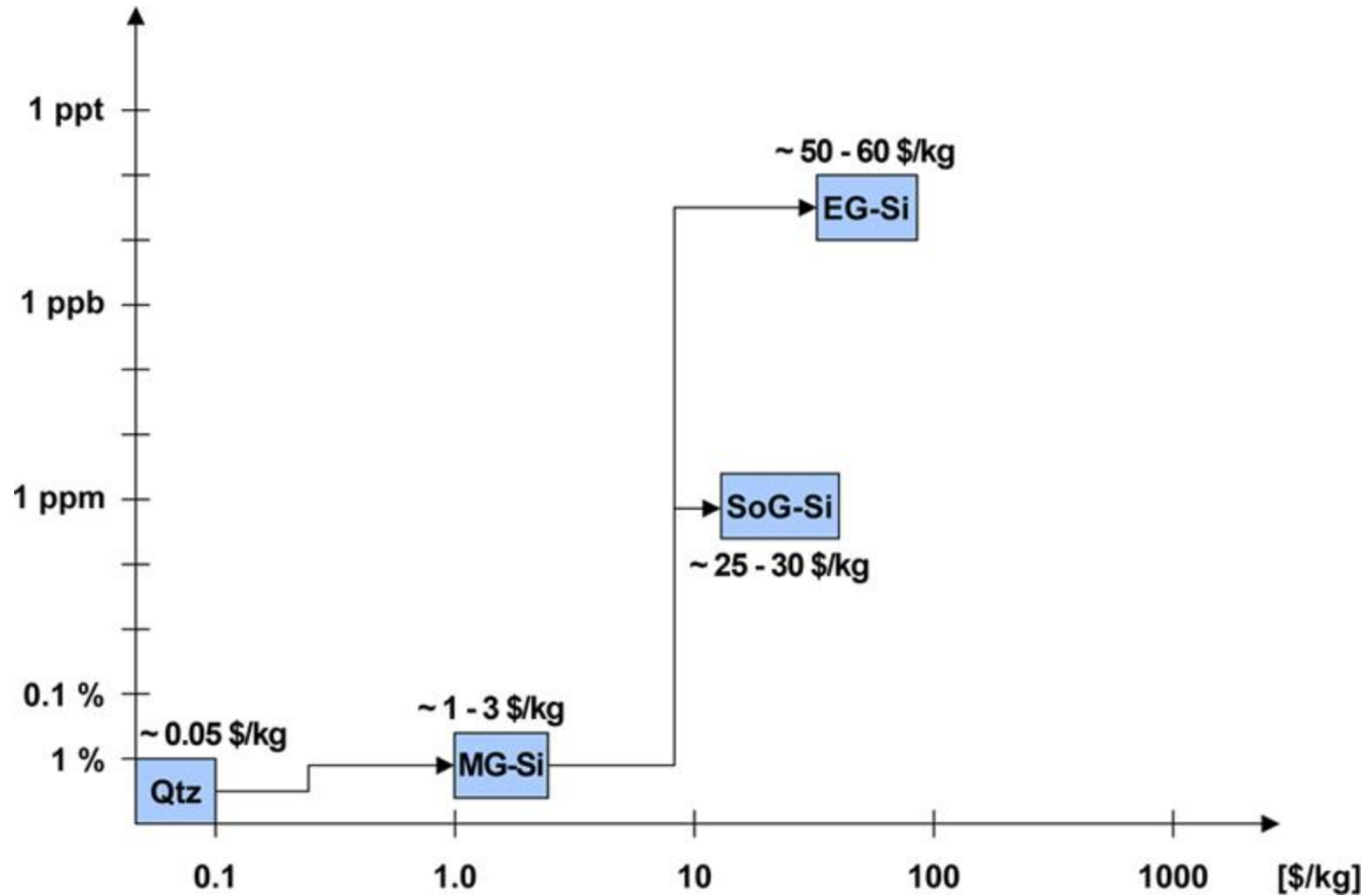


Solar Grade & Electronic Grade Analysis

Element	Metallurgical-grade silicon (ppm)	Solar-grade silicon (ppm)	Polycrystalline solar-grade silicon	Electronic-grade silicon (ppm)
Si*	99	99.999 9	99.999 99	99.999 999 999
Fe	2 000–3 000	<0.3		<0.01
Al	1500–4 000	<0.1		<0.0008
Ca	500–600	<0.1		<0.003
B	20	<0.3		<0.0002
P	20–50	<0.1		<0.0008
C	600	<3		<0.5
O	3000	<10		
Ti	160–200	<0.01		<0.003
Cr	50–200	<0.1		

* Si content in mass %

Purity and Price of Materials





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End of Presentation

Thank you for your attention