MATERION BERYLLIUM SUPPLY STATUS

Mr. Keith Smith  VP Operations & Technology
Mr. Lawrence Ryczek  VP Sales & Marketing
MATERION – Brush Beryllium & Composites
Elmore, Ohio USA

BeWS-10  September 2012
• MATERION Overview
• Materion Brush Beryllium & Composites
• Products and Services
• Sustainable Beryllium Supply – New Primary Beryllium Facility

• Appendix:
  – *Upgrading of S-65 Be Specification for ITER First Wall* by Aaron Sayer, Materion, 2011.
  – Materion Markets Overview
You may have known us as:
We are now: MATERION
Materion (MTRN)

• An Advanced Material Company
  – Lighter, stronger, faster, smaller, reliable

• Strong Global Positions in Attractive and Growing Markets

• Solid Record of Long-term Growth

• Strong Value Added* Margins

• Market Cap: $410 Million

• Annual Sales: $1.4 Billion (Forecast 2012)

• Strong Balance Sheet: Debt/Debt + Equity <23%

• EBITDA**: $90-95 Million (Forecast 2012)

* Excludes metal pass-through
** Earnings before interest, taxes, depreciation and amortization
A Global Platform

Operations in US and 11 Countries

- Customers in >50 countries
- Expanded presence in Asia

Significant International Sales*
Q2 2012

38%

*Percentage of value added sales
### Identify High Growth Secular Markets

<table>
<thead>
<tr>
<th>Market</th>
<th>Q2 2012 % of Value-added Sales</th>
<th>Trends</th>
<th>Key Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer Electronics</td>
<td>26%</td>
<td>↑</td>
<td>• Smartphone growth</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Tablet computers &amp; LEDs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Miniaturization</td>
</tr>
<tr>
<td>Industrial Components &amp;</td>
<td>19%</td>
<td>↑</td>
<td>• New airplane builds &amp; retrofits</td>
</tr>
<tr>
<td>Commercial Aerospace</td>
<td></td>
<td></td>
<td>• Increasing air travel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Heavy equipment builds</td>
</tr>
<tr>
<td>Defense &amp; Science</td>
<td>11%</td>
<td>↔</td>
<td>• DoD &amp; foreign military budgets</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Demand for communications satellites</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• High performance optical devices</td>
</tr>
<tr>
<td>Automotive Electronics</td>
<td>10%</td>
<td>↑</td>
<td>• Increasing global car production</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• HEV/EV lithium ion battery components</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Engine control &amp; electronic systems</td>
</tr>
<tr>
<td>Energy</td>
<td>8%</td>
<td>↑</td>
<td>• Directional drilling</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Nuclear</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Solar, batteries &amp; smart grid devices</td>
</tr>
<tr>
<td>Medical</td>
<td>8%</td>
<td>↑</td>
<td>• Glucose testing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Blood analysis test coating for medical diagnosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Diagnostics equipment</td>
</tr>
<tr>
<td>Telecommunications Infrastructure</td>
<td>6%</td>
<td>↑</td>
<td>• Global 3G/4G builds</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Base stations</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Undersea fiber-optics expansion</td>
</tr>
</tbody>
</table>
• Only Fully Integrated Producer of Beryllium and Beryllium Alloys in the World
  – Over 75 years of reserves at Utah

• Precision Optical Coatings – Visible to Infrared Bandwidth
  – “Go To” Supplier for defense, thermal imaging, space and medical applications

• High Purity Gold Products for Semiconductor Fabrication (Wireless & LED)
  – Offering “full metal management” capabilities

• Unique Copper-Nickel-Tin Material ToughMet®
  – Multiple advanced applications growing at over 30% annually

• Blood Analysis Test Coatings for Medical Diagnosis
## Successful Repositioning – Snapshot

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>→</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>$373M</td>
<td>→</td>
<td>$1.5B</td>
</tr>
<tr>
<td>Revenue % in Advanced Materials</td>
<td>47%</td>
<td>→</td>
<td>76%</td>
</tr>
<tr>
<td>Debt-to-Debt-Plus-Equity</td>
<td>43%</td>
<td>→</td>
<td>17%</td>
</tr>
<tr>
<td>Working capital * % of sales</td>
<td>41%</td>
<td>→</td>
<td>23%</td>
</tr>
<tr>
<td>Cyclicality</td>
<td>High</td>
<td>→</td>
<td>Lower</td>
</tr>
<tr>
<td>Growth</td>
<td>Low</td>
<td>→</td>
<td>Higher</td>
</tr>
</tbody>
</table>

* A/R, Inventory & A/P
High Value-Added Business Model

1. Identify high growth secular markets
2. Target the fastest growing niches of those markets
3. Expand with innovative products
4. Add synergistic acquisitions
5. Ensure financial discipline
**A Strong Record of Synergistic Acquisitions**

<table>
<thead>
<tr>
<th>Acquisitions 2005 - 2012</th>
<th>Add complementary products / technology</th>
<th>Impact</th>
<th>Accretive in year 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMC – shield kit cleaning – 2005</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>TFT – thin film coatings – 2005</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CERAC – inorganic chemicals – 2006</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Techni-Met – thin film coatings – 2008</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Barr – thin film coatings – 2009</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Academy – precious metals – 2010</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>EIS Optics – thin film coatings – 2011</td>
<td>✓</td>
<td>✓</td>
<td>TBD</td>
</tr>
<tr>
<td>AMC – metal matrix composites – 2012</td>
<td>✓</td>
<td>✓</td>
<td>TBD</td>
</tr>
</tbody>
</table>

Added over $440M to sales and approximately 30% of company profit in 2011
Value Added Sales: By Segment

Q2 2012

- **Performance Alloys**: 42%
- **Advanced Material Technologies**: 43%
- **Beryllium & Composites**: 9%
- **Technical Materials**: 6%
Value Added Sales: Beryllium and Composites

Q2 2012

- **Defense & Science**: 47%
- **Industrial Components & Commercial Aerospace**: 25%
- **Medical**: 9%
- **Telecommunications Infrastructure**: 9%
- **Energy**: 1%
- **Other**: 9%

Total: 100%
Continually Develop Innovative Products

• Leveraging customer-centric product development

• Active research programs to take advantage of secular trends

• Key product areas include
  – LEDs
  – Medical
  – Commercial Optics
  – Computer Hard Drives
  – Energy
  – Science
  – Commercial Aerospace
  – Hybrid & Electric Vehicles
  – Wireless
Company Core Technologies

1. High Purity Gold and Silver for Industrial Applications

2. Powder Science and Processing (Vacuum, Hot and Cold Isostatic Pressing) … Metal and Chemical

3. Full Metal Processing Technology (Melting, Casting, Rolling, Extrusion)

4. Selective Electroplating

5. Light Wave Management and Coating Technology

6. Thin Film Large Area Coating

7. Numerous “Specialties” … Cladding, Electron Beam Welding, Diffusion Bonding

8. Shield Kit Cleaning

9. Chemical Synthesis

10. Amorphous Metals
Beryllium and Composites
- Nearer net shape fabrication (hot isostatic pressing)
- Truextent™ speaker diaphragms
- Investment Casting
- Amorphous Metals
- SupremEX™ Aluminum Metal Matrix Composites
- Low cost BeO
- Advanced Beryllium processing methods.

Performance Alloys
- ToughMet® Alloy for High Volume Bearing Applications
- BrushForm 158 for Voice Coil Motor (VCM) applications
- Materion R270 Strip
- “Next Generation” Alloy for Oil & Gas

Technical Materials
- Hybrid & Electric Vehicle Battery Components
- Power Electronics
- Smart Grid Meters
- Computer Hard Drives (Dual Stage Activation)
- Medical Applications
Advanced Material Technologies

Materials

- Optics Coating Materials and Large Format Components
- Thin Film Electrodes (medical diagnostics)
- Expanded refining/chamber services – Complement to Thin Film Materials & Coating businesses
- Nanotechnology Materials
- Materials for High Brightness LEDs
- Specialty Inorganic Compounds (Solar, Security)
- Precious Metal Materials – rod, bar, sheet, slugs, etc.
- Global Refining and Metal Recovery and Management Services
- Ultra high purity Precious Metals for medical and semiconductor applications
- Next generation magnetic data storage thin film head materials
Advanced Material Technologies

Coatings

- Precision Optical Thin Film Coatings (specialty filters)
- Large format Thin Film Materials for large area coatings (Energy, Solar)
- Solar Panel Thin Film, Concentrator Materials and Barrier Film Coatings

Packaging

- Optical package for New Photonics applications
- RF packages for the latest transistor technology (3G and 4G infrastructure)
- MEMS and Photovoltaic Packaging Materials
Business Overview

World Leader in Beryllium Containing Materials

• Fully Integrated Beryllium Materials Supplier
  (mine – manufacture – sales – distribution - technical support)

• Over 1000 Employees at 10 Locations

• Manufacturing:
  • Delta, UT; Elmore, OH; Lorain, OH; Reading, PA, Freemont, CA, Tucson, AZ

• The Elmore plant is the company’s largest.

• Sales are 50% outside North America and Growing
Delta Facility
Statistics

- 73 employees - 43 hourly
- 1,250 hectares (3,080 acres) -Mill
- 3,000 hectares (7,400 acres) -Mine
- 9,300 m² (100,000 ft²) of building space
- 5th largest private sector employer in Millard Co.
- Facility established in 1968-69 production began in Sept. 1969 (mine land purchases began earlier in the 60's)
Delta Mine Operations

Topaz Mine

Unloading Ore at Mill
Delta Mill Operations

Wet Grind

CCD

Leach

Solvent Extraction
Delta Mill Operations

- Beryl Ore
- Beryl Plant
- Beryl Furnace
- Beryllium Hydrolysis
Elmore Manufacturing Facility
Elmore Facility – Statistics

- 640 employees
- 180 hectares (439 acres)
- 93,000 m² (1,000,000 ft²) of building space
- Second largest private sector employer in Ottawa County
Major Product Forms - Alloy

- Strip
- Rod
- Wire
- Plate
- Bar
- Tube
- Billet
- Casting Alloys
- Machined Parts
Primary Operations

Direct Chill Casting
Strip Operations

- Hot Rolling
- Slab Milling
- Cold Rolling
Strip Operations

Anneal & Pickle

Age

Finish Pickle
Bulk Products Manufacturing
Material selection is based on combinations of mechanical and physical properties

- **Strength**
- **Conductivity, resistivity**
- **Formability, ductility, crimpability**
- **Stability**
- **Stiffness**
- **Magnetic permeability**
- **Corrosion resistance**
- **High Temperature Properties**
- **Damage tolerance**
**Beryllium & Composites Manufacturing**

- **Business**: Production of Be and Be containing materials.
- **Markets**: Defense, Aerospace.
  - Satellites, optical systems, nuclear, avionics, inertial guidance.
- **Processes**:
  - Extractive metallurgy
  - Powder Metal production and consolidation
  - CNC machining
  - Casting
- **Research and Development**:
  - Advanced materials processing (I/C, amorphous alloys)
- **Applications Engineering and Project Management - SPADE**
Why Beryllium?
Our materials enable engineers to design and build lighter, faster, accurate, and more reliable systems.

- Lighter than Aluminum
  - Stiff
- Transparent to X-rays
- Unique nuclear properties
  - Dampens vibration
- Good thermal properties
Beryllium:

- Seven commercial grades of Beryllium metal:
  - S200F, S200FH, S200FC, I70, **S65**, I220, I220H
  - Block, Parts, Sheet, Extrusions

- Beryllium Foil – multiple grades (Materion Electrofusion)

- Ultra High-purity Beryllium

- Beryllium hydroxide

- Beryllium fluoride
Aluminum Beryllium:

- AlBeMet: AM162
- Investment Castings - AlBeCast
  - Grades 910 and 920

Beryllium Oxide: Materion Ceramics, Tucson, AZ

- Powder and consolidated ceramic products.

Composite Materials:

- E-materials: Be – BeO composite (20%, 40%, 60% BeO)
- SupremEX – Metal Matrix Composites (Al based composites)
The NEW Pebble Plant
Pebble Plant Expansion

Why new plant?

- Old Pebble Plant:
  - 40 years old
  - Obsolete Equipment
  - Poor Condition

Need for new plant to compete in 21st Century.
Government – Industry Cost Share

Pebble Plant cost: $100 million

- Materion cost share: $25 M
- US Government share: $75 M

Defense Production Act Title III Program.
Pebble Plant……Nov 2008
Pebble Plant Opening

Marcy Kaptur – US Congress
Richard Hipple – CEO Materion

Robert Latta – US Congress
Plant Design Goals:

• Use lessons learned from the “old plant”.

• Design with high level of safety.

• Highly automated operation.

• Use best available environmental technology.
Pebble Process Overview

- Be Hydroxide (Utah)
- Wet Plant
- ABF Salt Production
- Fluoride Furnace
- Reduction Furnace
- Pebble Finishing
- Recycle

Pebble to Production Facility
Pebble Plant
Current Production Status

- Pebble quality meets all specifications.
- Characterization of product completed in mid-2012.
We are operating the plant at needed levels to satisfy market demand, with additional available capacity.
Strategic Goal Satisfied

Long Term Supply of Beryllium Assured at MATERION.
Forward-Looking Statements

VISION
We will be a global leader in innovative advanced material solutions and services that enable our customers to excel in their markets

MISSION
... in support of our vision:
- We manufacture materials that enable technologies to provide a safer and more sustainable future
- We provide exceptional value to our customers globally through innovative technology and service, and continuous supply chain improvement
- We are passionately focused on being our customers’ first choice
- We commit to building a strong financial future for our employees and shareholders, striving to consistently grow revenues and earnings
- We design, manufacture and distribute our products in a safe, environmentally responsible manner

VALUES
We embrace a set of individual and team values, where:
- Working safely is everyone’s first priority
- We collaborate with each other, our customers and our suppliers to create higher value for our customers
- We conduct all business affairs with the highest standard of ethics and integrity
- We leverage disciplined processes and data-driven methods to continuously improve
- We empower individuals and teams to achieve our goals
- We embrace change and reject complacency
- We commit to attracting and developing diverse, global talent, and to creating a culture where all employees can do their best work
- We partner in the betterment of our communities
Appendix
Upgrading of S-65 Be Specification for ITER First Wall

Aaron B. Sayer, P.E.
Materion
Outline

• Grade Comparison
• Reasons for Improvement
• Production Flow Chart
• Micrographs
• Properties
• S-65 Specification Change – What’s New?
## Comparison of Possible Beryllium Grades for ITER First Wall

<table>
<thead>
<tr>
<th>Chemical element</th>
<th>ITER I/O Spec</th>
<th>S-65 E (new)</th>
<th>S-65 C (old)</th>
<th>JET S-65 H</th>
<th>CN-G01</th>
<th>CN-G01m</th>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Spec from BeWs 8, 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beryllium Assay, % minimum *</td>
<td>99.0</td>
<td>99.2</td>
<td>99.0</td>
<td>&gt;99</td>
<td>&gt;99</td>
<td>99.02</td>
<td>98.84</td>
<td>98.8</td>
<td></td>
</tr>
<tr>
<td>Beryllium oxide, % maximum</td>
<td>1.0</td>
<td>0.9</td>
<td>1.0</td>
<td>1.0</td>
<td>0.9-1</td>
<td>0.7</td>
<td>0.95</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Aluminium, % maximum</td>
<td>0.06</td>
<td>0.05</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Carbon, % maximum</td>
<td>0.10</td>
<td>0.09</td>
<td>0.10</td>
<td>0.10</td>
<td>0.06</td>
<td>0.05</td>
<td>0.06</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Iron, % maximum</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
<td>0.06</td>
<td>0.06</td>
<td>0.16</td>
<td>0.13</td>
<td>0.15</td>
</tr>
<tr>
<td>Magnesium, % maximum</td>
<td>0.06</td>
<td>0.01</td>
<td>0.06</td>
<td>0.06</td>
<td>0.005</td>
<td>0.005</td>
<td>0.021</td>
<td>0.013</td>
<td>0.02</td>
</tr>
<tr>
<td>Silicon, % maximum</td>
<td>0.06</td>
<td>0.045</td>
<td>0.06</td>
<td>0.06</td>
<td>0.01</td>
<td>0.01</td>
<td>0.04</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Uranium, % maximum **</td>
<td>0.0030</td>
<td>0.015</td>
<td>0.015</td>
<td>0.04</td>
<td>0.04</td>
<td>n/d</td>
<td>0.0005</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Other metallic impurities, % maximum</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
<td>&lt;0.04</td>
<td>&lt;0.04</td>
<td>&lt;0.04</td>
<td>&lt;0.04</td>
<td>&lt;0.04</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Properties

<table>
<thead>
<tr>
<th></th>
<th>Per paper*****</th>
<th>Actual Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTS (MPa)</td>
<td>290</td>
<td>420</td>
</tr>
<tr>
<td>TYS (MPa)</td>
<td>205</td>
<td>303</td>
</tr>
<tr>
<td>Elongation (%)</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

* Items in red do not meet the ITER I/O specification

* Difference (i.e. 100% - other elements)

** Proven method of measurement of Uranium content shall be proposed by Manufacturer of material and agreed with DA and IO.

*** The content of other elements (e.g. Cr, Ni, Cu, Ti, Zr, Zn, Mn, Ag, Co, Pb, Ca, and Mo) shall be reported for information.

****"Recent Progress of Plasma Facing Material Research at SWIP", X. Liu, et al, Southwestern Institute of Physics, China


******"Characterization of Chinese Beryllium as the Candidate Armor Material of ITER First Wall, X. Liu et al, Southwestern Institute of Physics, China"
<table>
<thead>
<tr>
<th>Element</th>
<th>% Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cr</td>
<td>0.01</td>
</tr>
<tr>
<td>Ni</td>
<td>0.025</td>
</tr>
<tr>
<td>Cu</td>
<td>0.025</td>
</tr>
<tr>
<td>Ti</td>
<td>0.025</td>
</tr>
<tr>
<td>Zr</td>
<td>0.025</td>
</tr>
<tr>
<td>Zn</td>
<td>0.005</td>
</tr>
<tr>
<td>Mn</td>
<td>0.005</td>
</tr>
<tr>
<td>Ag</td>
<td>0.005</td>
</tr>
<tr>
<td>Co</td>
<td>0.005</td>
</tr>
<tr>
<td>Pb</td>
<td>0.005</td>
</tr>
<tr>
<td>Ca</td>
<td>0.005</td>
</tr>
<tr>
<td>Mo</td>
<td>0.005</td>
</tr>
</tbody>
</table>
Reasons for Improvement

• 3MC42Z ITER I/O Beryllium Specification, “Material Specification for the supply of Beryllium blocks for the ITER First Wall application”
  - Uranium of 30 ppm

• Refinements and adjustments to the process for reduced Uranium led to reduction of other elements and an increase in %Be.
  - BeO, Al, C, Mg, Si, Cr, Ni, Cu, Ti, Zr, Zn, Mn, Ag, Co, Pb, Ca, Mo
Uranium Reduction in S-65

- Discovered that steps can be taken to remove uranium from beryllium with the following results:
  - Product A: 3 – 6 ppm Uranium
  - Product B: 20 – 70 ppm Uranium

- In addition, Materion has a process to reduce Product A Uranium further:
  - Less than 5 ppm

<table>
<thead>
<tr>
<th>Lot</th>
<th>Fluorometric (ppm U)</th>
<th>Neutron Activation (ppm U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot 1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Lot 2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Lot 3</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Lot 4</td>
<td></td>
<td>2.9</td>
</tr>
<tr>
<td>Lot 5</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Lot 6</td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>Lot 7</td>
<td></td>
<td>1.9</td>
</tr>
<tr>
<td>Lot 8</td>
<td></td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>1.7</strong></td>
<td><strong>1.5</strong></td>
</tr>
</tbody>
</table>
Uranium in S-65 for ITER

- First production S-65 lot shipped to ITER IO Specification 3MC42Z in 2011.
  - Not all Uranium reduction methods used
  - Uranium by GDMS: 7 ppm
S-65 Flow Chart

1. Beryllium Feed
2. Vacuum Cast ingot
3. Chipping
4. Impact Grind
5. Powder Blending
6. Vacuum Hot Press Consolidation
7. Density
8. Check chemistry and mechanical properties
Impact Ground S-65 Powder
S-65 Mechanical Properties 2000 – 2011

**Specification**

**S-65 UTS**

- Count: 10, 20, 30, 40, 50, 60, 70
- Kilo Pounds per Square Inch (ksi): 42.0, 44.0, 46.0, 48.0, 50.0, 52.0, 54.0, 56.0, 58.0, 60.0, 62.0

**S-65 TYS**

- Count: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120
- Kilo Pounds per Square Inch (ksi): 30.0, 32.0, 34.0, 36.0, 38.0, 40.0, 42.0
## S-65 Specification Changes

<table>
<thead>
<tr>
<th>Chemical element</th>
<th>3MC42Z</th>
<th>ITER I/O Spec</th>
<th>S-65 E (new)</th>
<th>S-65 C (old)</th>
<th>Typical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beryllium Assay, % minimum *</td>
<td></td>
<td>99.0</td>
<td>99.2</td>
<td>99.0</td>
<td>99.4</td>
</tr>
<tr>
<td>Beryllium oxide, % maximum</td>
<td></td>
<td>1.0</td>
<td>0.9</td>
<td>1.0</td>
<td>0.66</td>
</tr>
<tr>
<td>Aluminium, % maximum</td>
<td></td>
<td>0.06</td>
<td>0.05</td>
<td>0.06</td>
<td>0.03</td>
</tr>
<tr>
<td>Carbon, % maximum</td>
<td></td>
<td>0.10</td>
<td>0.09</td>
<td>0.10</td>
<td>0.03</td>
</tr>
<tr>
<td>Iron, % maximum</td>
<td></td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
<td>0.075</td>
</tr>
<tr>
<td>Magnesium, % maximum</td>
<td></td>
<td>0.06</td>
<td>0.01</td>
<td>0.06</td>
<td>0.005</td>
</tr>
<tr>
<td>Silicon, % maximum</td>
<td></td>
<td>0.06</td>
<td>0.045</td>
<td>0.06</td>
<td>0.025</td>
</tr>
<tr>
<td>Uranium, % maximum **</td>
<td>0.0030</td>
<td></td>
<td>0.015 (will meet 0.0030 for ITER)</td>
<td>0.04</td>
<td>0.001</td>
</tr>
<tr>
<td>Other metallic impurities, % maximum</td>
<td>0.04</td>
<td></td>
<td></td>
<td>0.04</td>
<td></td>
</tr>
</tbody>
</table>

### Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>ITER I/O</th>
<th>S-65 E (new)</th>
<th>S-65 C (old)</th>
<th>Typical</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTS (MPa)</td>
<td>290</td>
<td>290</td>
<td>290</td>
<td>386</td>
</tr>
<tr>
<td>TYS (MPa)</td>
<td>205</td>
<td>205</td>
<td>205</td>
<td>234</td>
</tr>
<tr>
<td>Elongation (%)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Positioned in Diverse Set of High-Growth Markets

Entered multiple leading-edge growth markets since 2002
Applications: Smart Phones

Internal Antenna Contacts

Grounding Clips and Audio Jacks

Micro Mezzanine Connectors for LCD Screen

I/O Connector Contacts

Battery Contacts

Internal Electronics
- Precursor materials for GaAs wafer production

Internal Electronics and LED
- Thin Film Materials – Power amplifiers, LED, SAW and BAW devices, filters, and ICs
- Hermetic Solutions for SAW
- Refining / Recycling
- Precision Parts Cleaning

Other Smart Phone Applications:
- Circuit Board and IC Inspection
- RoHS Compliance Assurance
- Cellular Infrastructure with High Power RF Packaging
- Voice Coil Motor (auto-focus lens stabilizer)
Applications: Aerospace

- Avionics/Electrical Systems
- Airframe Structure
- Flight Control Mechanisms
- Horizontal Stabilizer & Rudder Attachments
- Landing Gear Components
- Hydraulic Systems
- Fuel Systems
- Safety Slide Mechanism
- Doors & Hatches
- Wing Attachments
- Engine and Pylon Attachments
- Landing Gear Attachments
- Flight Attendant Jumpseat Spring

Other Aerospace Applications:
- Baggage Inspection
- Nondestructive Evaluation (Cracked Component Detection)
Applications: Oil & Gas

- Wellhead Control Equipment
- Structural Rig Components
- Drill Bits
- Directional Drilling Equipment
  - MWD, LWD, MPT Systems

Under Water Wellhead Equipment
- ROV’s, blow out preventers, hydraulic actuators, control fluid couplings

Other Oil & Gas Applications:
- Artificial Lift Equipment
- Elemental Analysis
- Down Hole X-Ray Inspection
Technology: Crystalline Silicon (Si)
Interconnect Materials
Front and backplane systems for high efficiency designs.

Technology: Flexible Solar Cells / Building Integrated Photovoltaic:
Thin Film Services:
Solar cells built in flexible substrates to accommodate applications such as roofing tiles or defense.

Technology: Copper Indium Gallium Selenide (CIGS)
Thin Film (PVD) Materials as well as Powders for Printing CIGS applications
Copper Indium Gallium Selenide thin film and screen printing applications for flexible and rigid solar cells.

Technology: Amorphous Silicon (a-Si, tandem and multi-junction)
Thin Film (PVD) Materials
Silicon based photovoltaic cells
Front and back contact layers
TCO Transparent Conductive Oxide layers

Technology: Cadmium Telluride (CdTe)
Thin Film (PVD) Materials
Cadmium based solar cell architecture. N and P type Cadmium Semiconductor materials
TCO Transparent Conductive Oxide layers
Front and Back-contact layers

Technology: Concentrator Photovoltaic (CPV)
Thin Film (PVD) Materials
Solar technology based on concentrating Solar rays into a semiconductor device via large lens.
Anti-Reflection Coating Materials
Precious metal contact materials

Micro Electronic Packaging Products:
Bonding Ribbon - Au & Ag
Lead-free Solders
Metalized Ceramic Substrates

Applications: Solar Energy
Applications: Medical

Seizure Control
- Thin Film Deposition Implantable Electrode – Parkinson's disease (R&D)

X-Ray Mammography

Subcutaneous Glucose Analysis
- Thin Film Coatings – Electrode Monitoring device

External Glucose Analysis
- Subcutaneous sensors for glucose measurement

Insulin Pump
- EMI Shielding and Grounding
- Electrical Terminals in Connectors

Cardiac Rhythm Management
- Electronic Interconnects/Components
  - Niobium/Titanium Electron Beam Weld

Radiation Therapy – Neutron Reflectors

Other Medical Applications:
- DNA Sequencing Optics
- CT Scan
- Diagnostic X-Rays
- Advanced Drug Delivery Components
- Diagnostic Electronic Components
- Anesthesia Monitoring Components
- Operating Instruments
Applications: Telecommunications Infrastructure

**Base Stations**
- Coaxial Connectors
- High Power Amplifiers

**Local Area Networks**
- Shielding
- Modular Jacks
- PCB Sockets
- Processor Sockets

**Other Telecommunications Infrastructure Applications**
- Undersea Repeater Housings
Applications: Automotive Electronics

- Lithium Ion Battery Interconnects
- Battery Management Resistors
- Fuel Pump and Fuel Level Sensors
- Battery & Relay Control Modules
- Electronic Power Steering Modules
- Auto Dimming Mirror Connectors
- Window and Door Switches
- Mirror & Windshield Electronic Connections
- Air Bag Sensors
- On Board Telematics
- Turn Signal and Emergency Flasher Relays
- Camera Optics
- Engine Efficiency Oxygen Sensors
- Night Vision Optics
- Speed Control Optics
- Hybrid Vehicle Motor & Module Connectors
- Engine Ignition and Control Modules
- Battery Terminals
- ABS Leadframes
- Lamp Socket Connectors
- On Board Telematics
- Applications: Automotive Electronics
Applications: Defense

- Infrared Sensors for Fighter Jet and UAV Optical Targeting
- Electronic Packaging for Defense Avionics, Radar and Electronic Countermeasure Systems
- Structural and Electronic Components for Satellites
- X-ray Windows in Security Imaging Systems
- Laser Protection Optical Coatings
- Night Vision System Optics