

Niche Market Opportunities for Small and Mid-sized Companies



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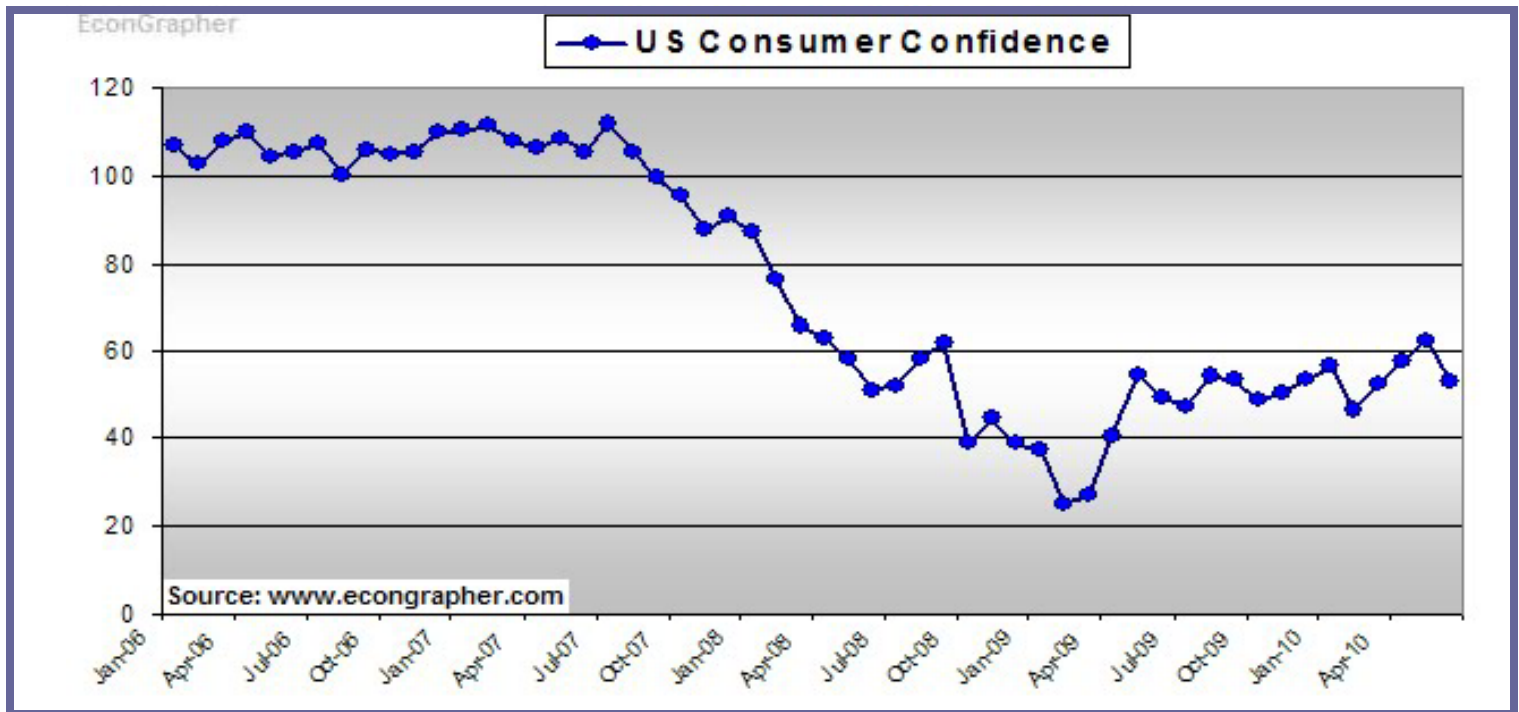
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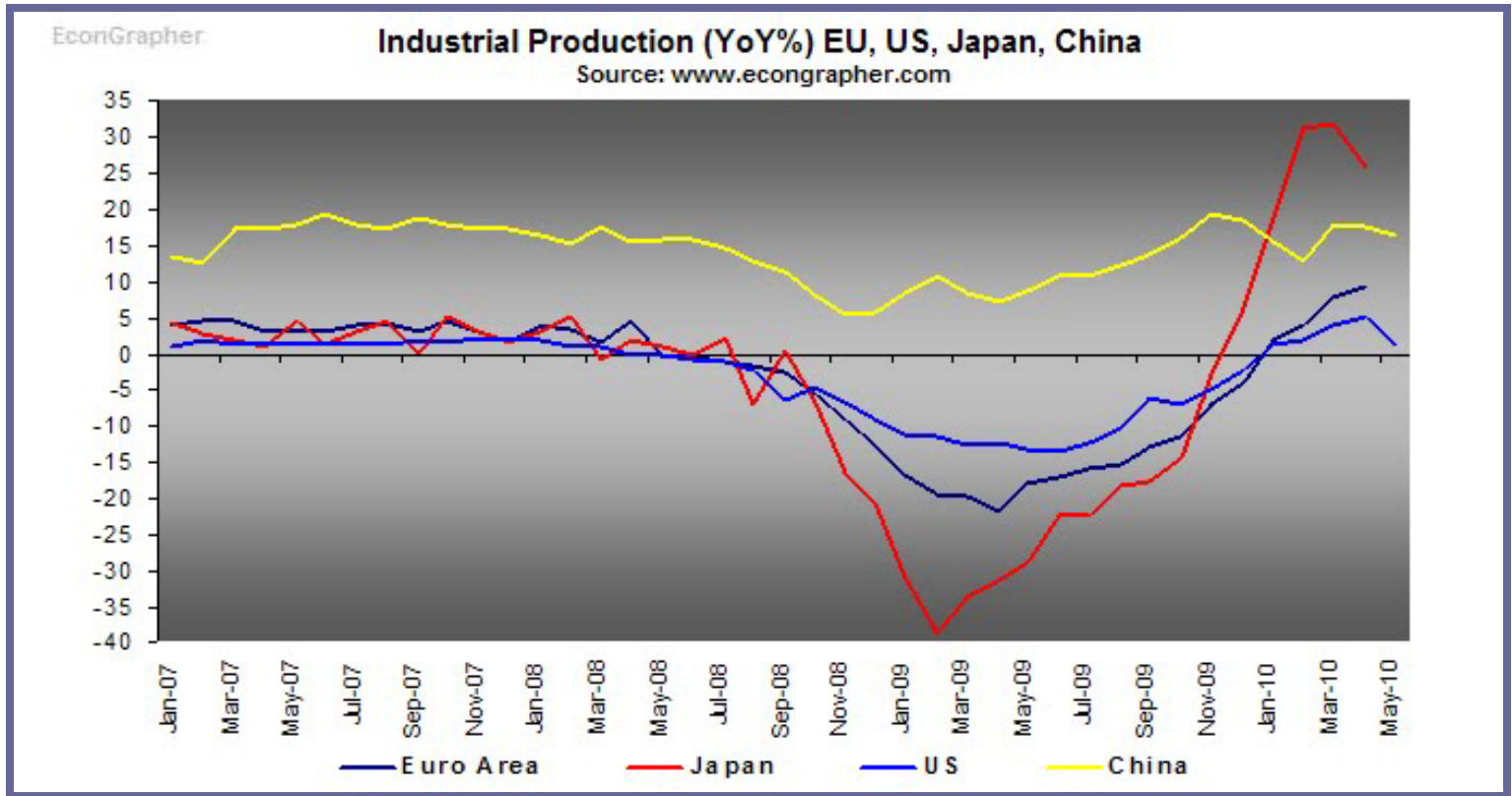
Setting The Record Straight

- A joke told by Warren Buffett comes to mind: a patient, after hearing from a doctor that he has cancer, tells the doctor, “Doc, I don’t have enough money for the surgery, but maybe could I pay you to touch up the x-ray?”
- Hope and self-deception are not a strategy.
- We at The Information Network are neither a pessimist nor an optimist, we are a realist.

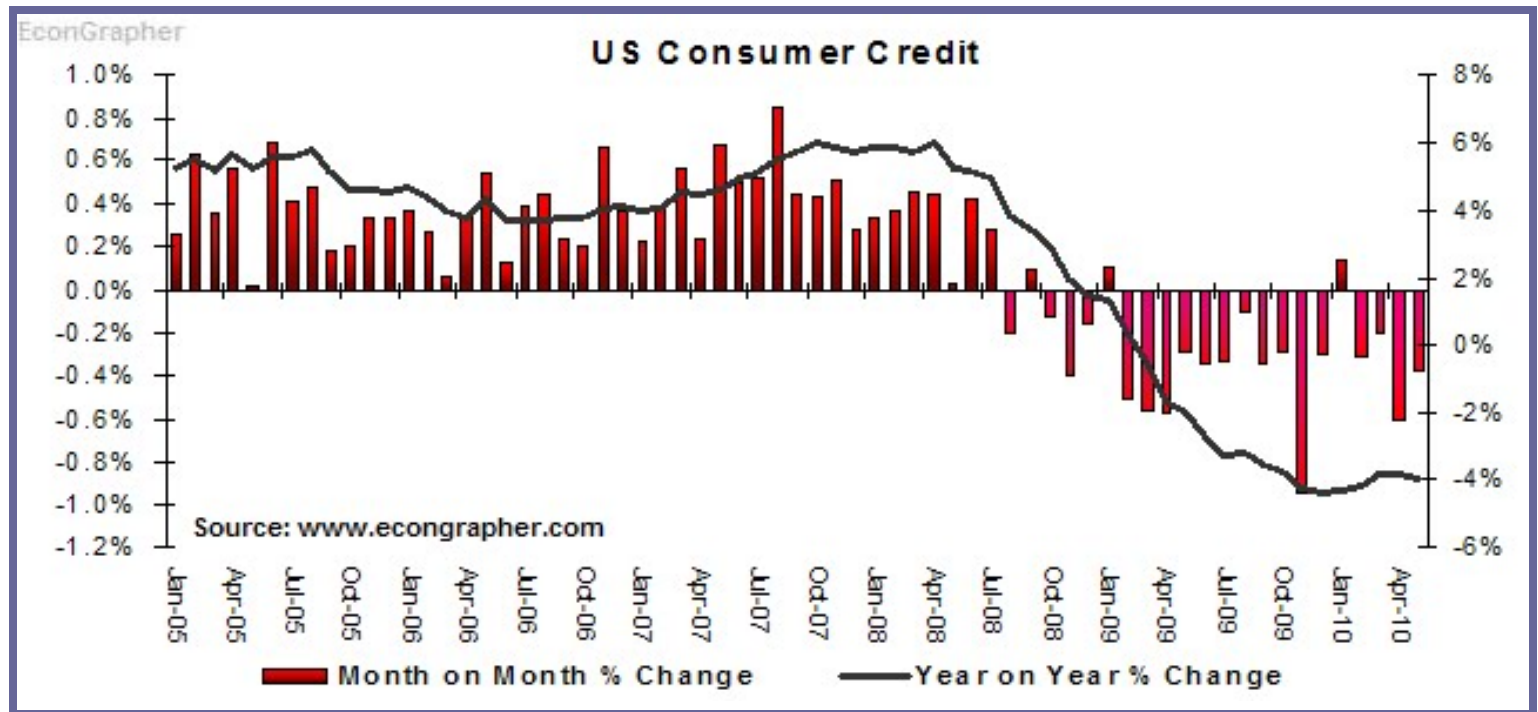
And The Reality Is That Things Are Not Very Good Out There



Industrial Production Worldwide Is Waning



We Can't Readily Get Credit



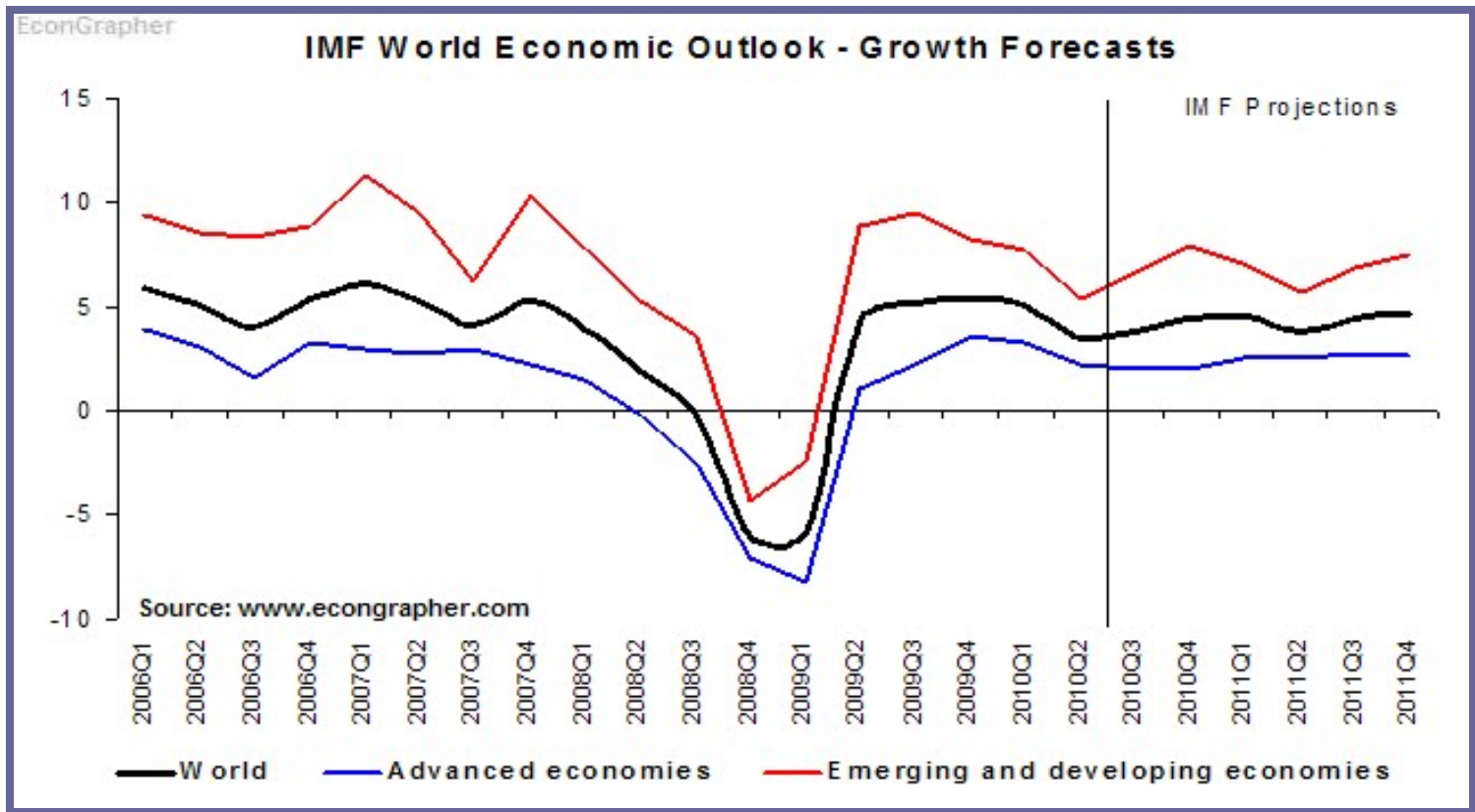
Unemployment Is Obscene



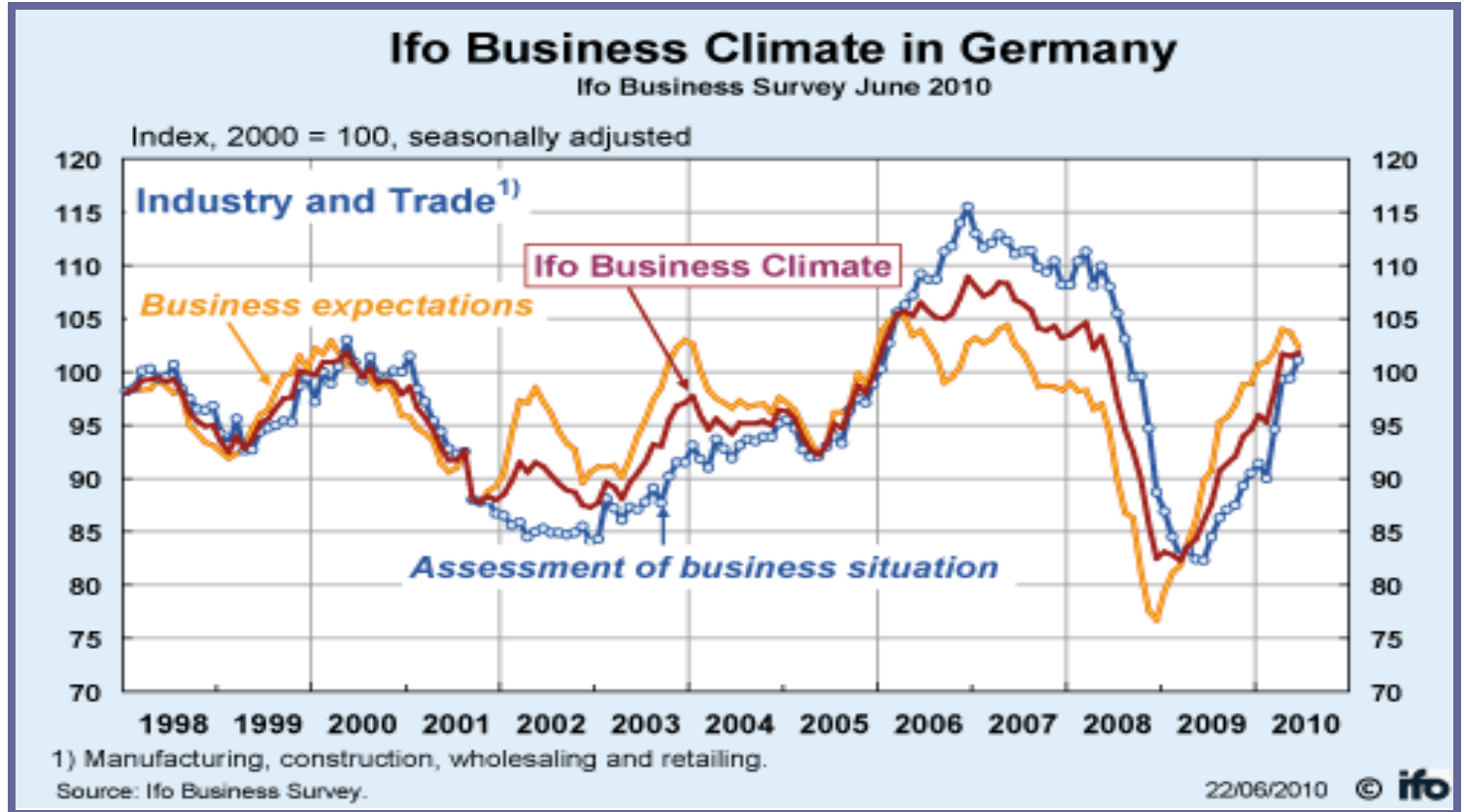
What Did That \$750 Billion Stimulus Package Do For Jobs?



But There Are Glimmers of Hope



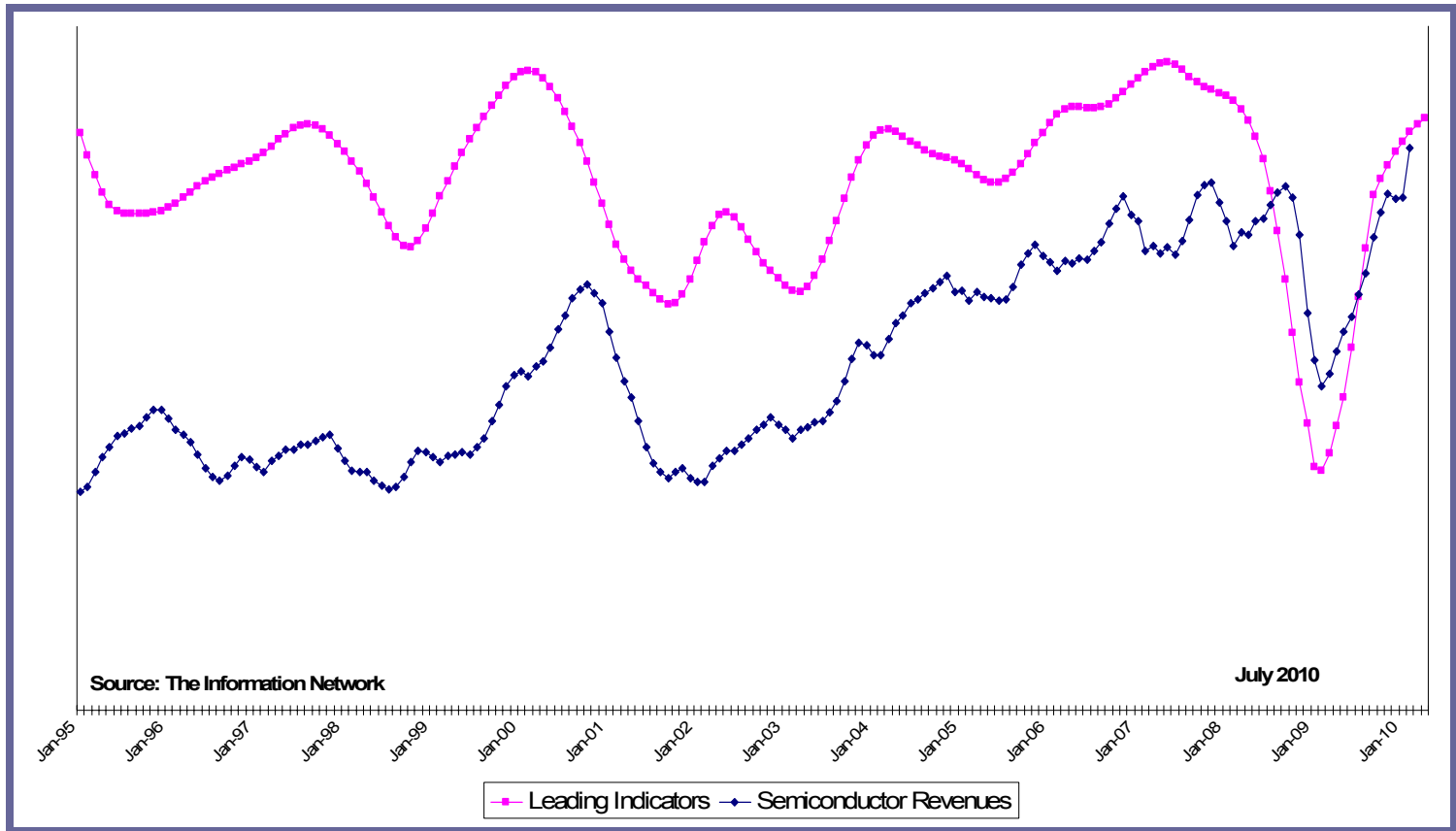
The Business Climate In Germany is Improving



*Without A Strong Economy
Sales Are In the Toilet*



This Is Why We Utilize Our Proprietary Leading Indicators



Competing Against Large Companies Exasperates Problems



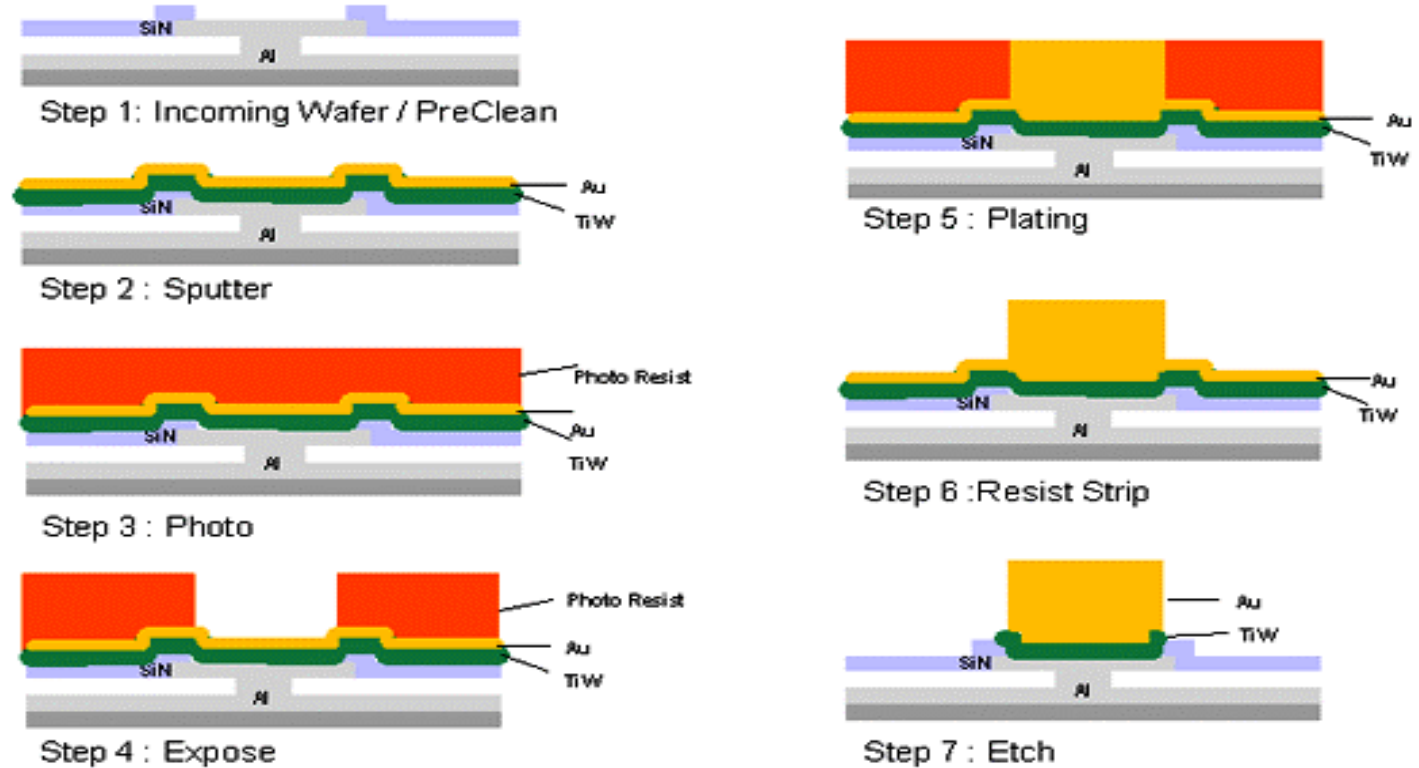
One Solution – Niche Markets

The small business even with its limited resources can better serve these market segments by customized offerings, because the products of the big business will often be too generic to suit the needs of a niche market audience.

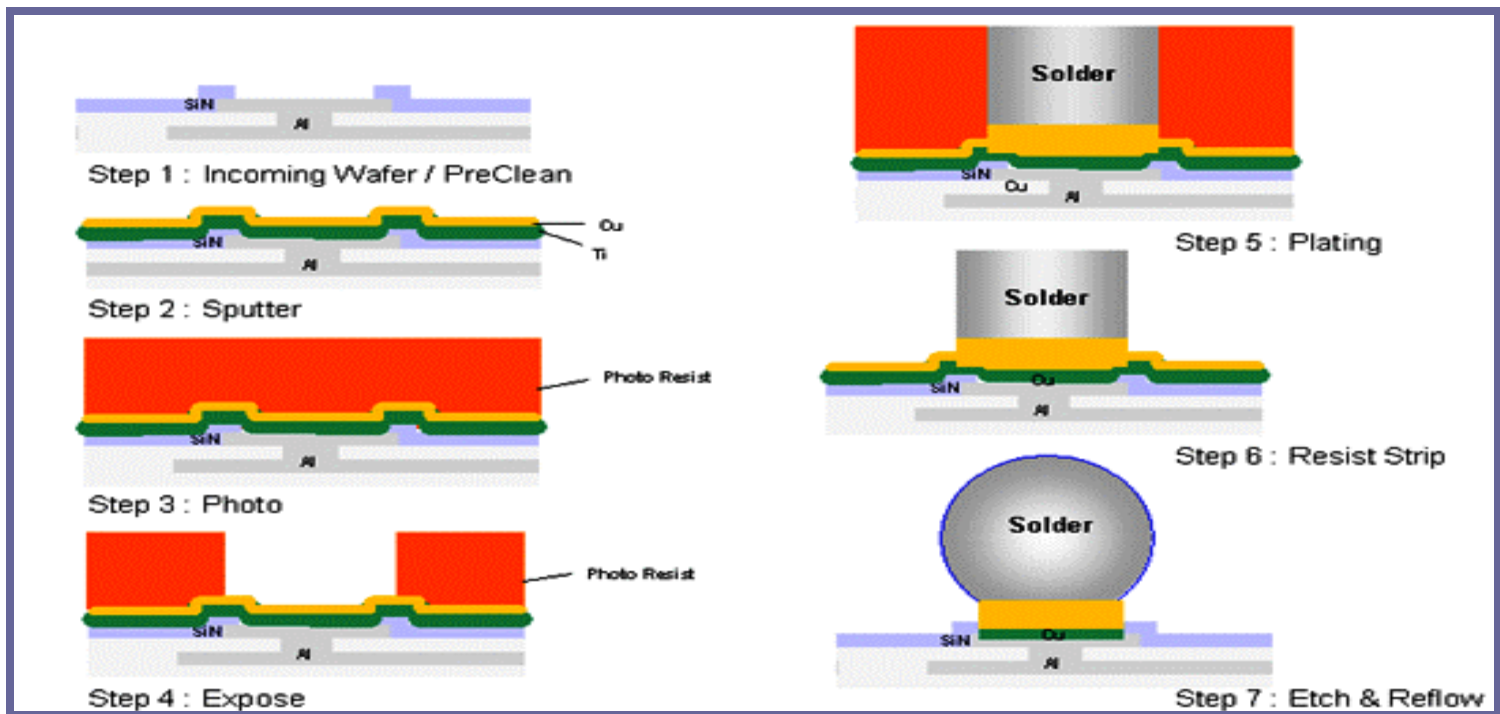
Niche Applications by Wafer Size

- High-tech applications that are fabricated on 300mm wafers
 - **Packaging**
 - MEMs
- High-tech applications that are built on non-300mm wafers.
 - **Solar**
 - LEDs

Packaging – WLP Gold Bump



Packaging – WLP Solder Bump

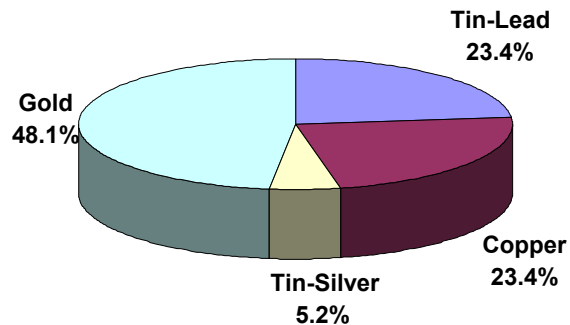


WLP Metallization Materials

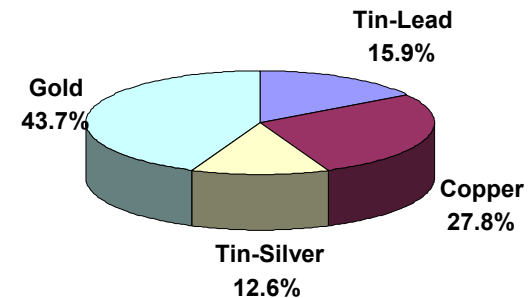
UBM STACK	BUMP	BUMP METALLURGY
Ti:W(N) / Au	Au	Au
Ti / Cu	Solder	Sn5Pb95 (high-Pb)
Ti:W / Cu		Sn37Pb63 (eutectic)
Al / NiV / Cu		Sn96.5 / Ag3.5 (Pb-free)
Ti / Ni		Sn99.3 / Cu0.7 (Pb-free)
Cr / Cr-Cu / Cu		Sn95.5 / Ag3.8 / Cu0.7 (Pb-free)

WLP Market by Bump Material

2009 - 5.0 Million 300mm Wafer Equivalents



2011 - 7.1 Million 300mm Wafer Equivalents

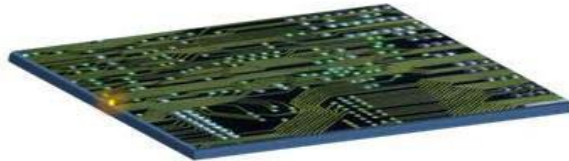


Through Silicon Via (TSV) – A Solution To Extending Moore's Law

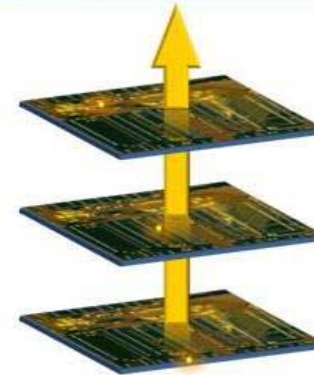
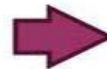
PARADIGM SHIFT IN CHIP BUILDING REQUIRED

SINGLE LAYER

STACKED



2 Dimensional



3 Dimensional

R E S U L T S

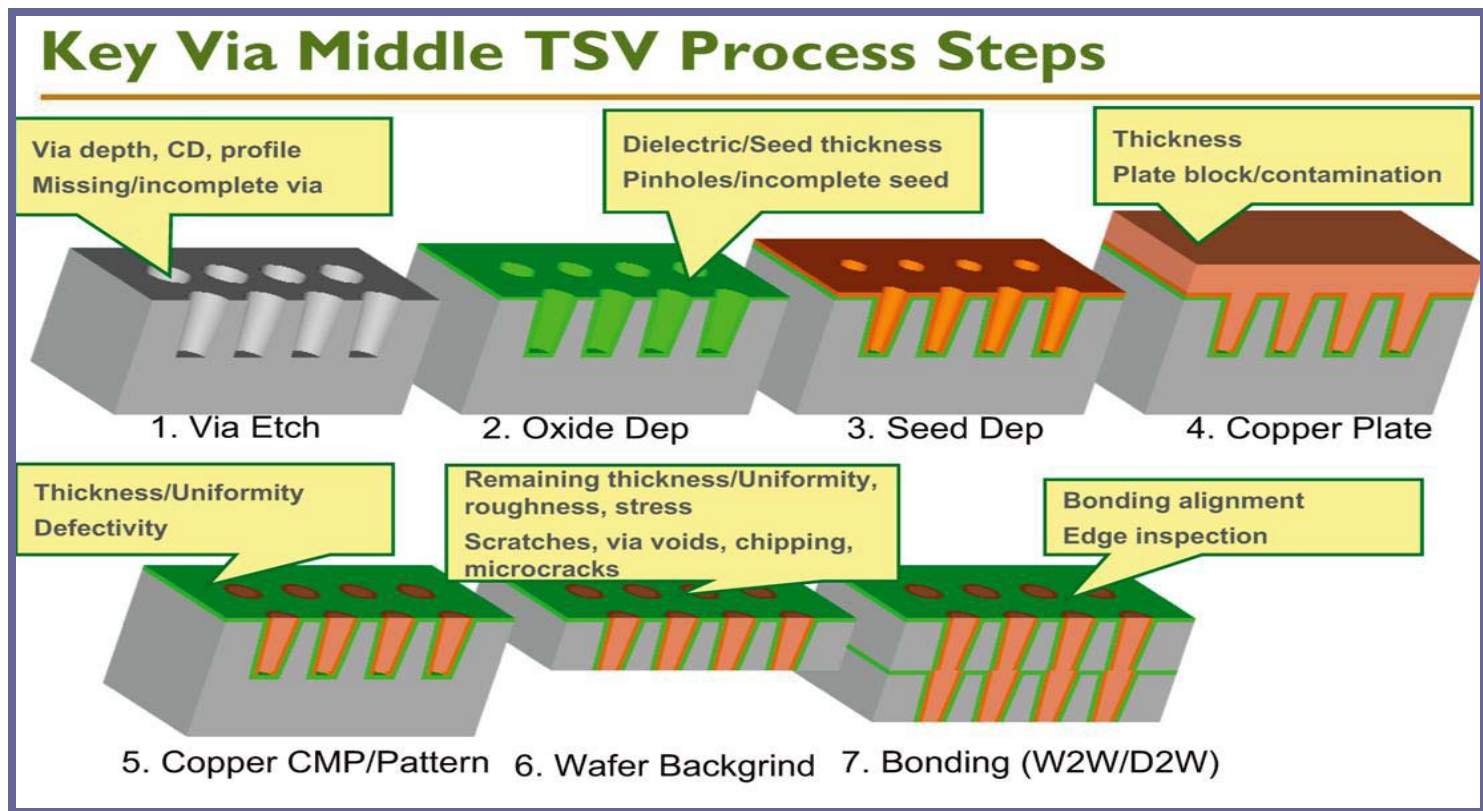
- » Increased processing speed
- » Decreased power requirements
- » Smaller footprint
- » Decreased heat output



TSV Differences

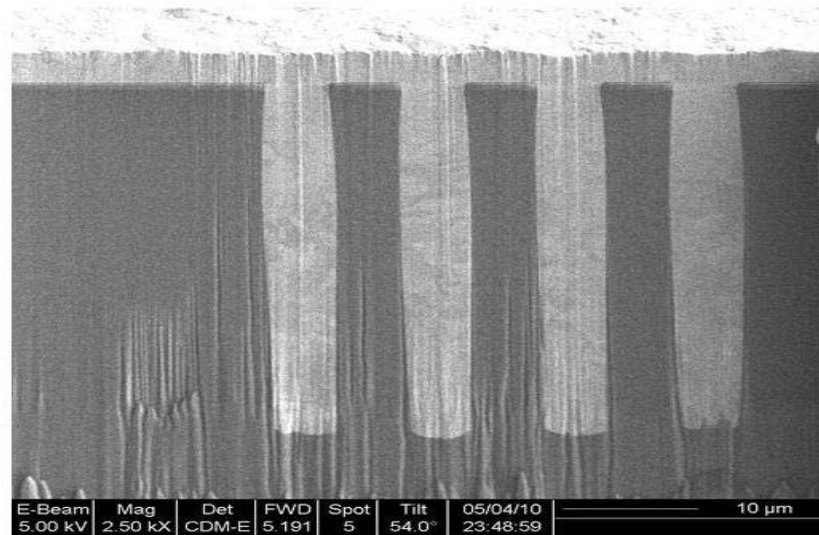
- Via-First used for CIS which isn't really a challenge
- Via after FEOL (transistor development post W-plug) and Via-Middle both called **iTSV** for 'interconnect TSV'.
 - By far a majority of development is going into this area

Packaging – TSV Via Middle (iTTSV – interconnect TSV)



iTSV – Via Formation and Fill Are Critical Steps

5 μ m x 50 μ m (10:1) TSV



Courtesy SEMATECH

Target 2 μ m/min Cu fill time

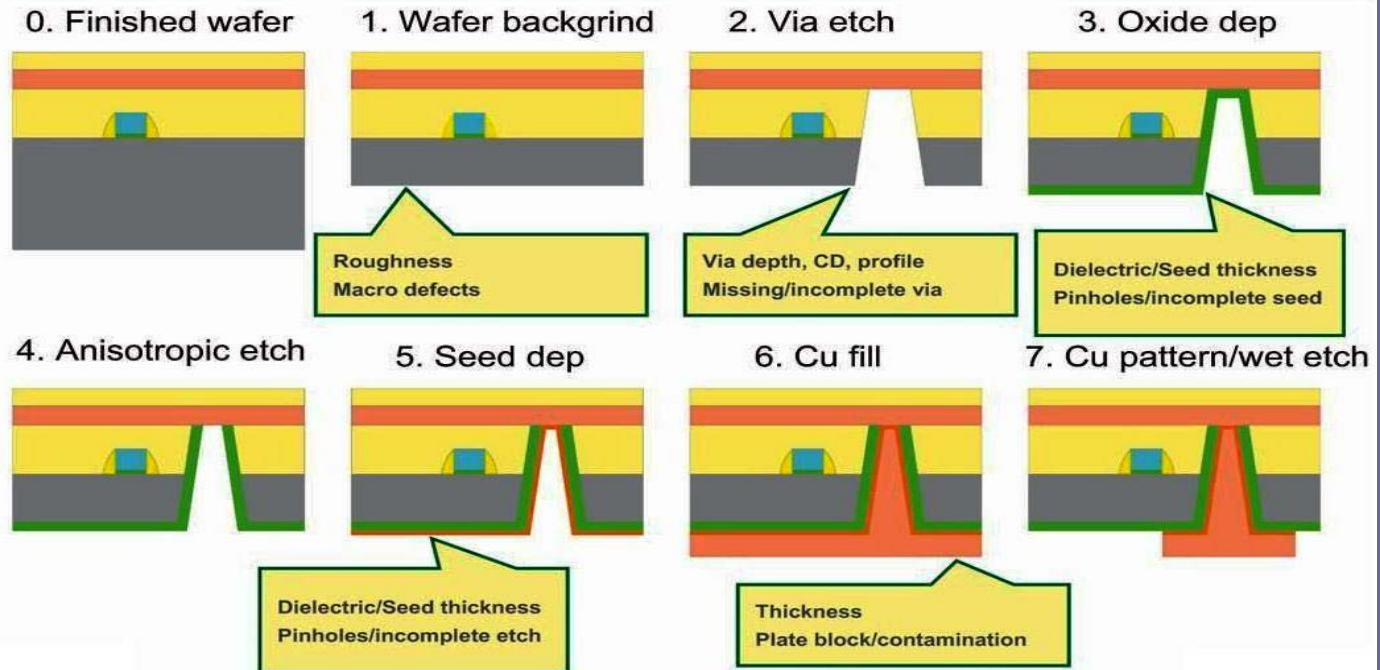


TSV Differences

- Via Before/after bonding called **pTSV** which is ‘Packaging TSV’ typically done by DRAM & Flash R&D
- Larger diameter via-last pTSV used in DRAM and interposers have significantly different challenges than the smaller diameter high aspect ratio iTSV structures

Packaging – TSV Via Last (pTSV – packaging TSV)

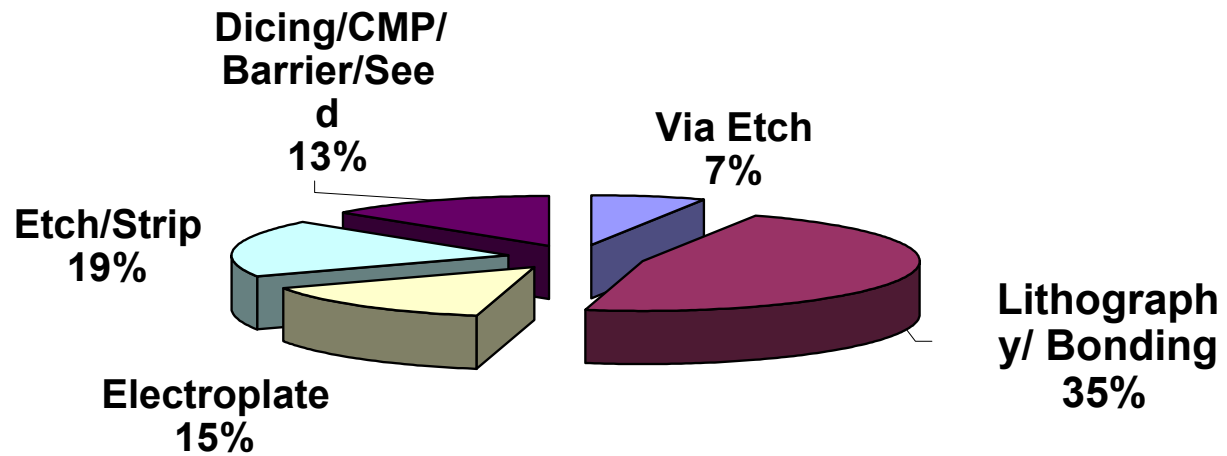
Typical Via Last Process Control Steps



Note: Cu fill may be conformal

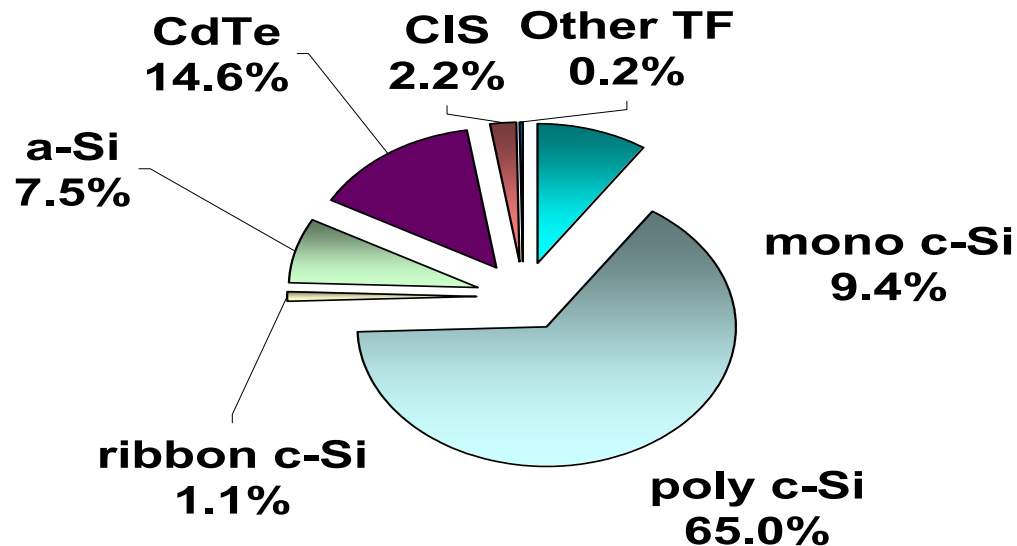
iTSV Equipment Breakdown

iTSV 5 x 30 um

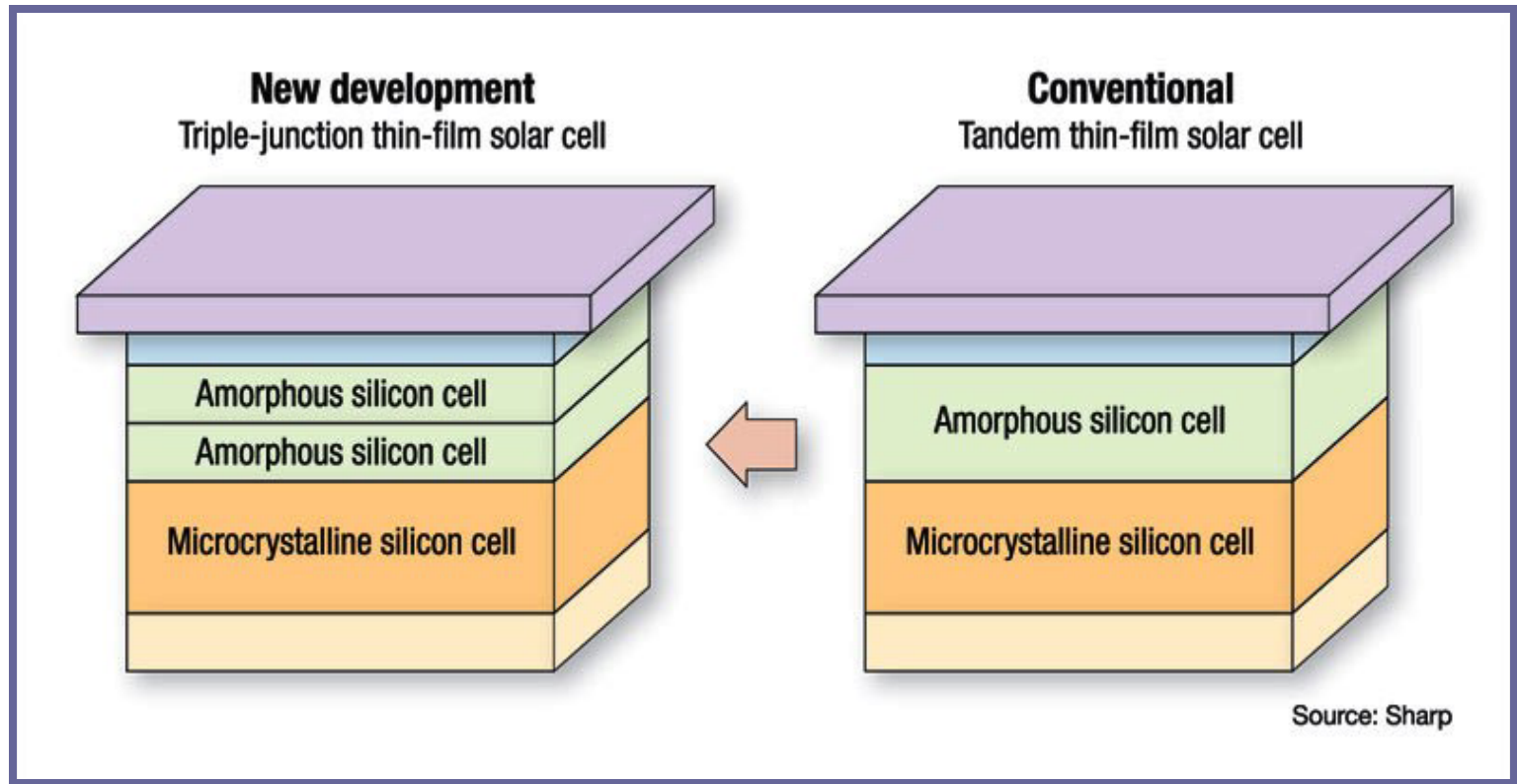


Solar Cells – Thin Film and Crystalline

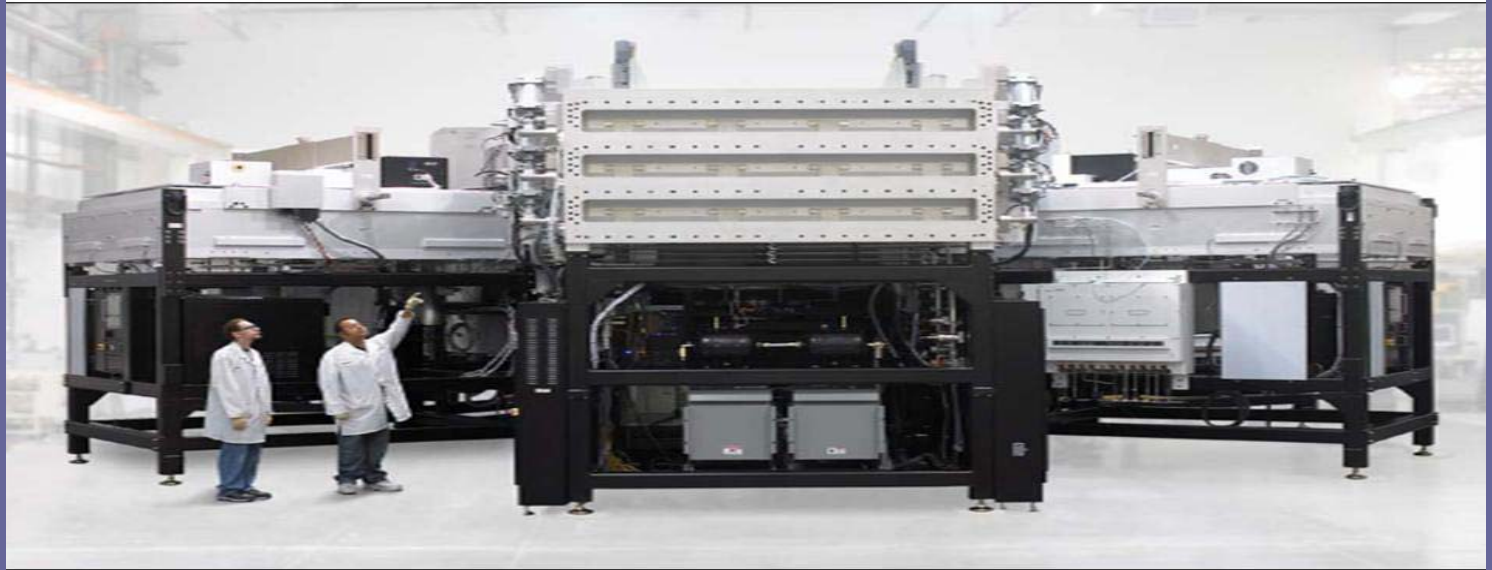
2009 Solar Cell Percentage Breakout by Type



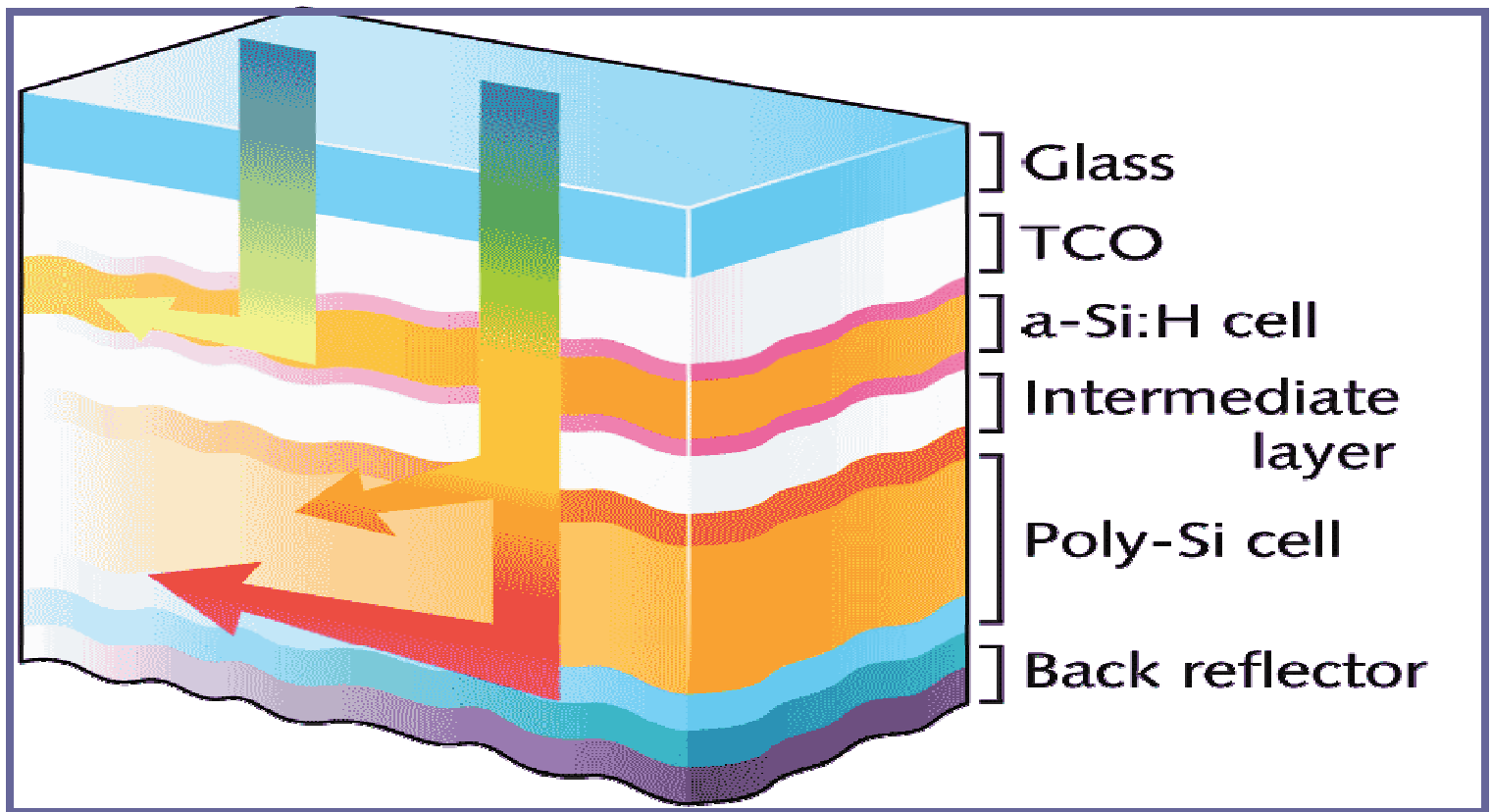
a-Silicon Multijunction Stack Solar Cell



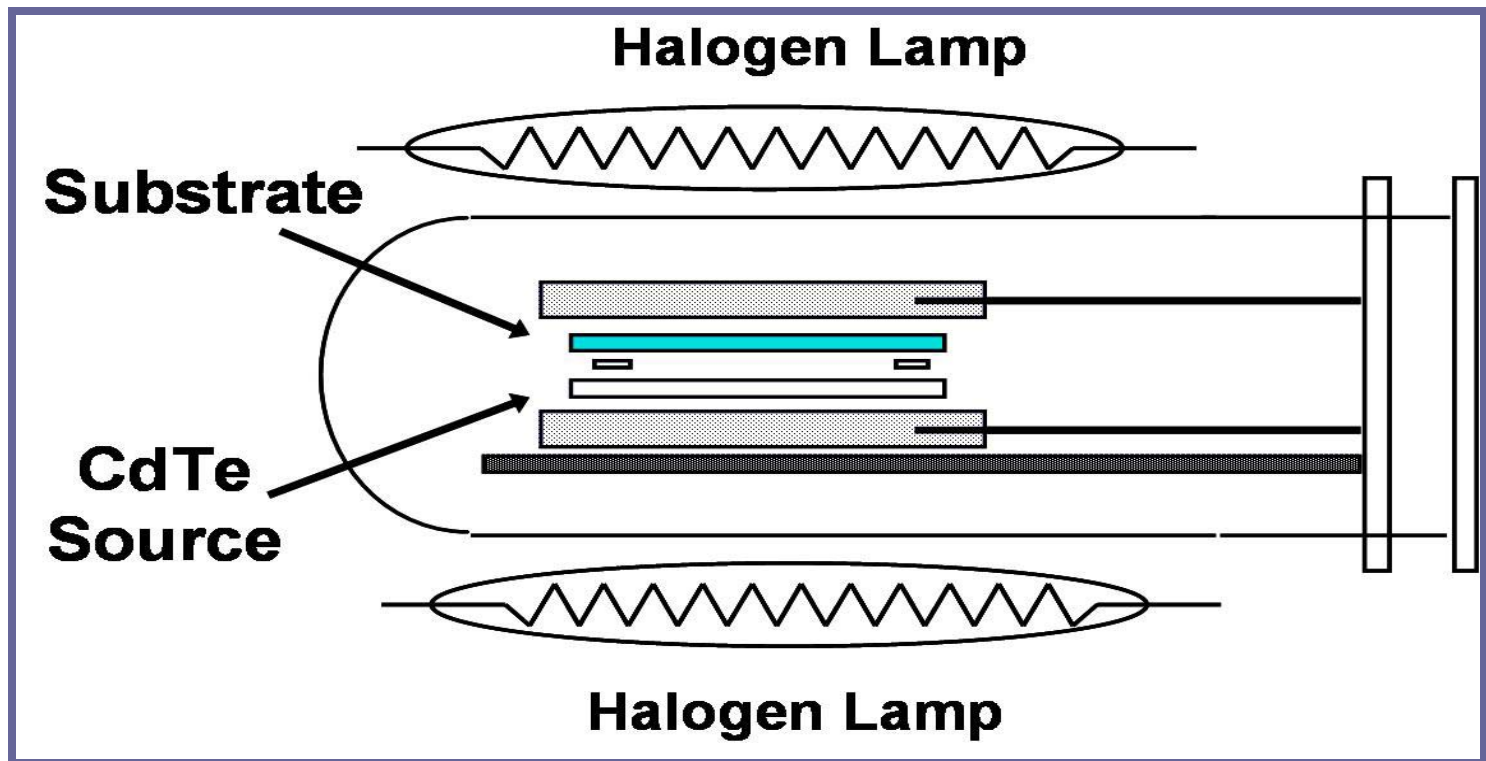
a-Silicon Multijunction Stack Equipment



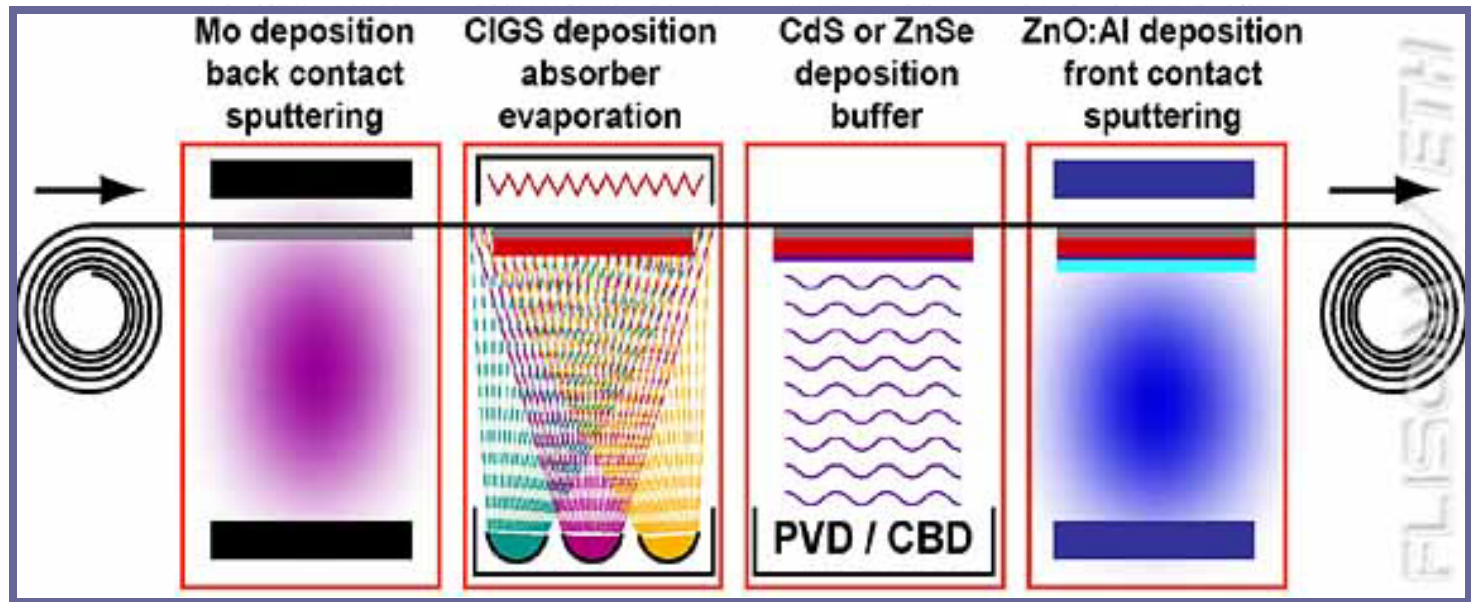
α -Silicon Multijunction Stack Solar Cell



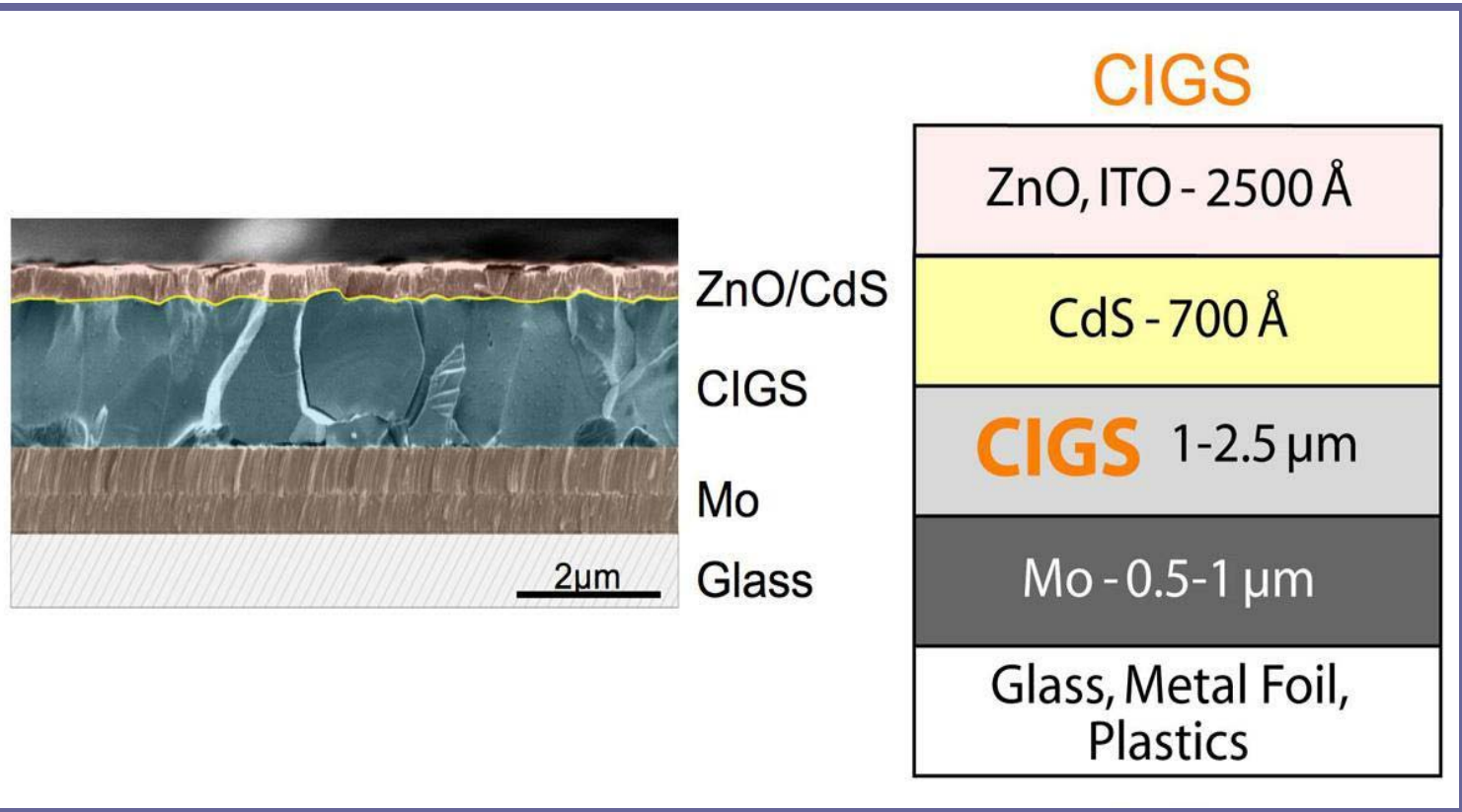
CdTe Solar Cell



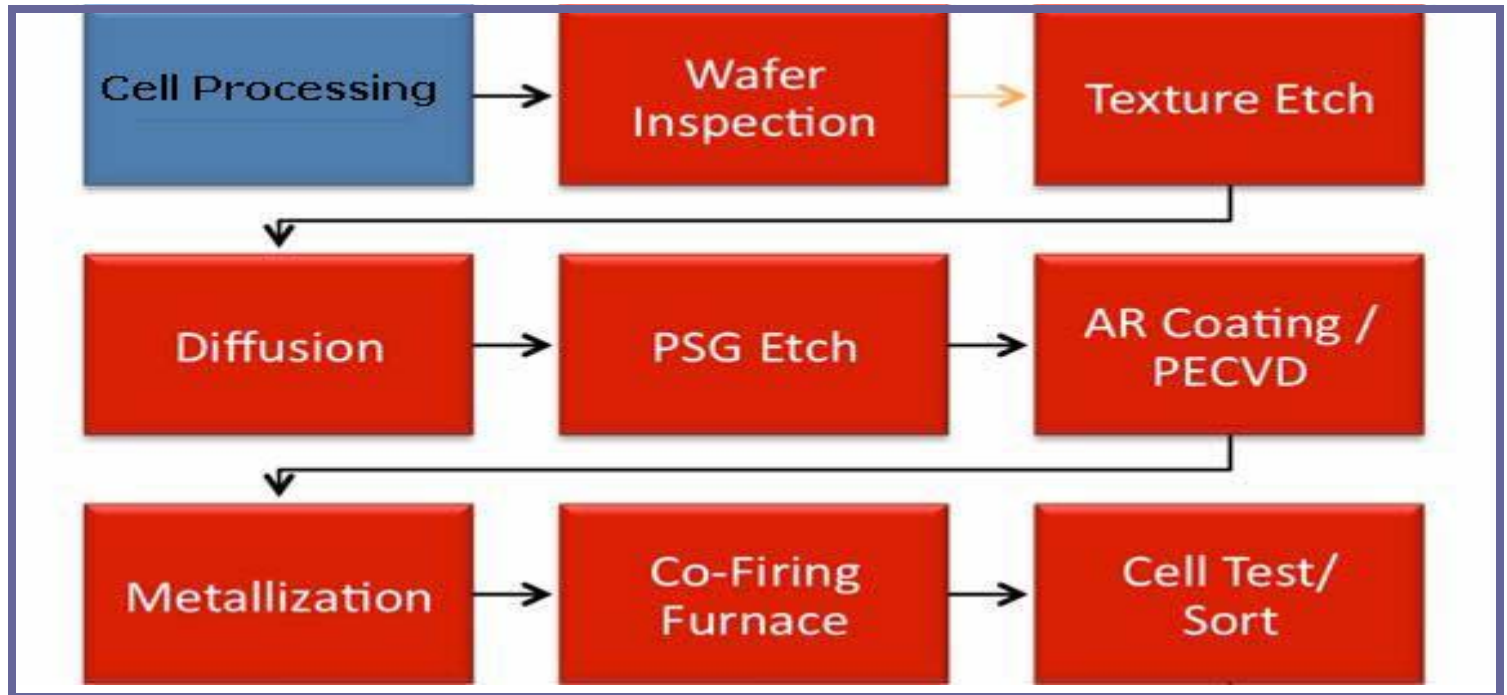
CIGS (Copper Indium Gallium Selenide) Solar Cell



CIGS (Copper Indium Gallium Selenium) Solar Cell



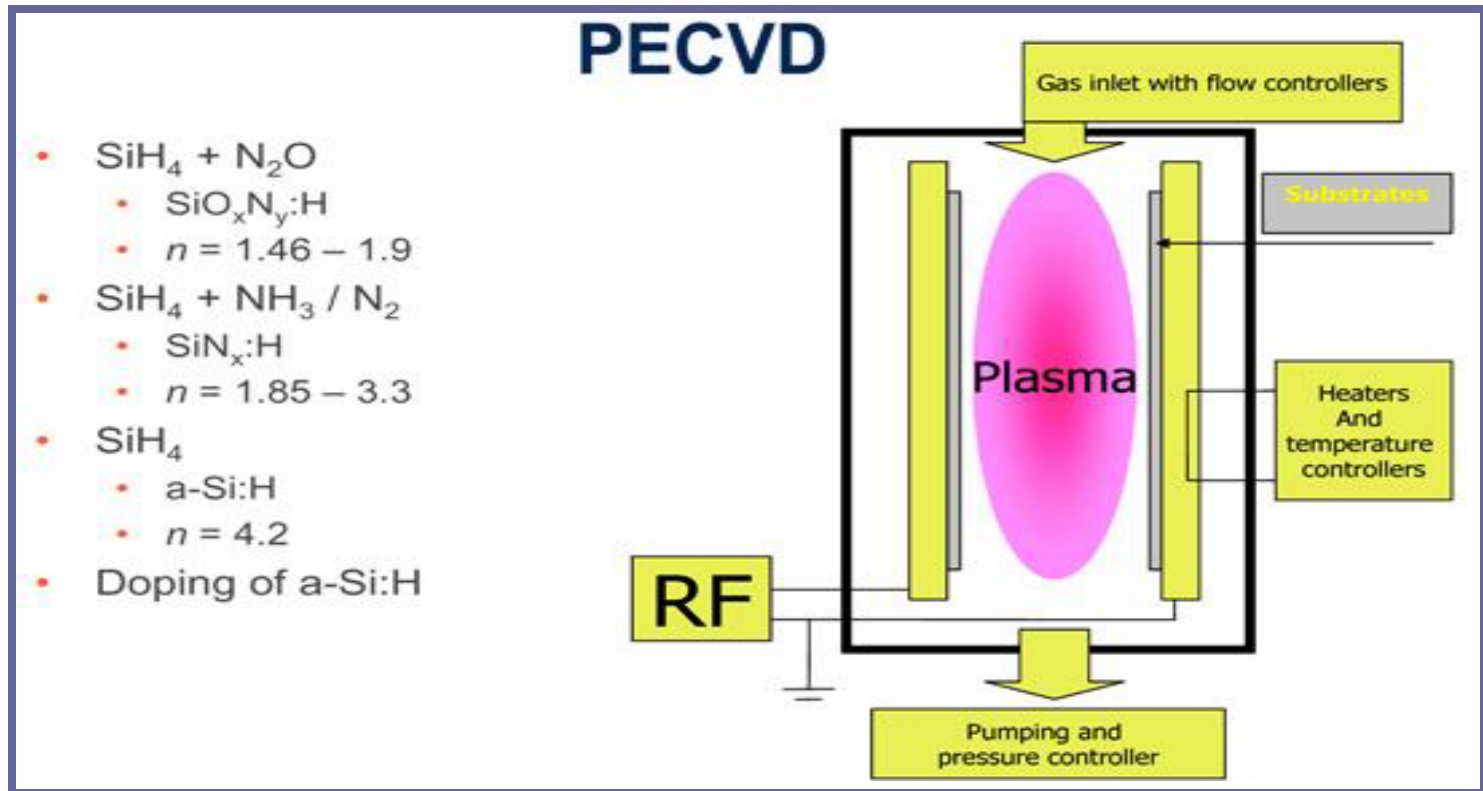
Silicon Solar Cells



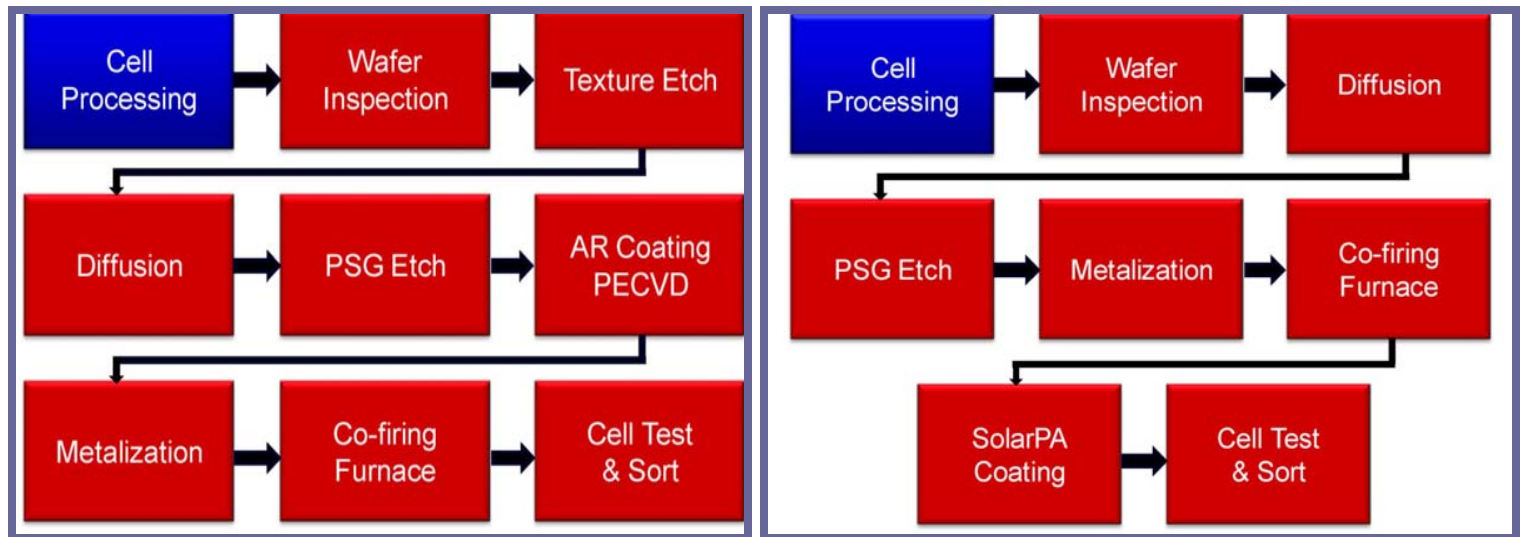
Silicon Solar Cells Types of Commercial ARC films

- Titanium Oxide, TiO_2
 - Atmospheric Pressure Chemical Vapor Deposition
- Indium Tin Oxide, ITO
 - Transparent conducting oxide
- Silicon Oxide, SiO_2
 - Thermal oxidation
 - High temperature
 - Passivates surface
- Silicon Nitride, $\text{SiN}_x\text{:H}$
 - Plasma Enhanced Chemical Vapor Deposition (PECVD)
 - Low Temperature
 - Passivates Surface and Bulk

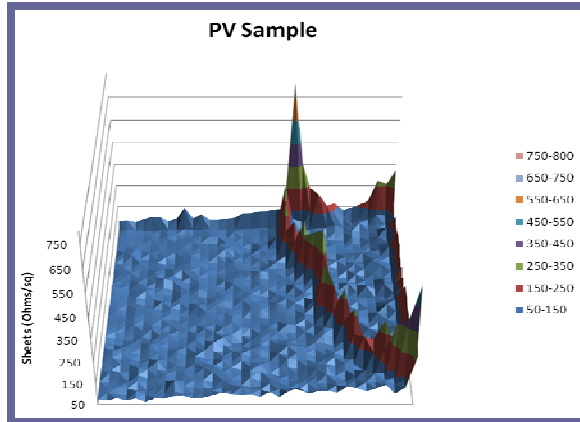
Commercial ARC Film Deposition



Silicon Solar Cells – Watch for Disrupting Technologies



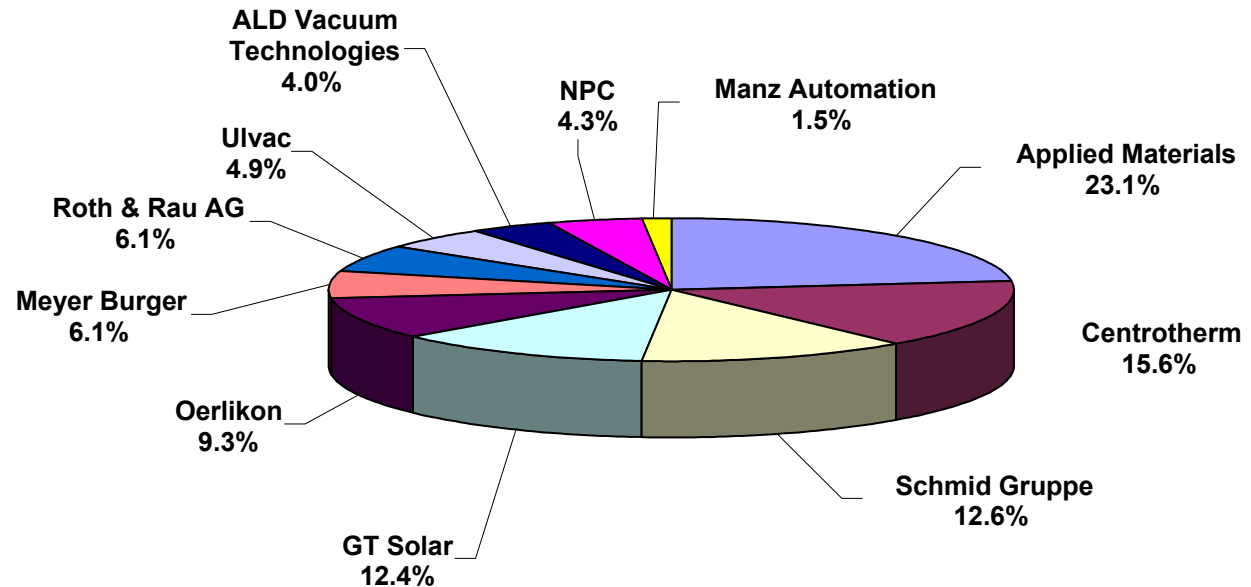
Silicon Solar Cells – Or Look To Develop New Technology



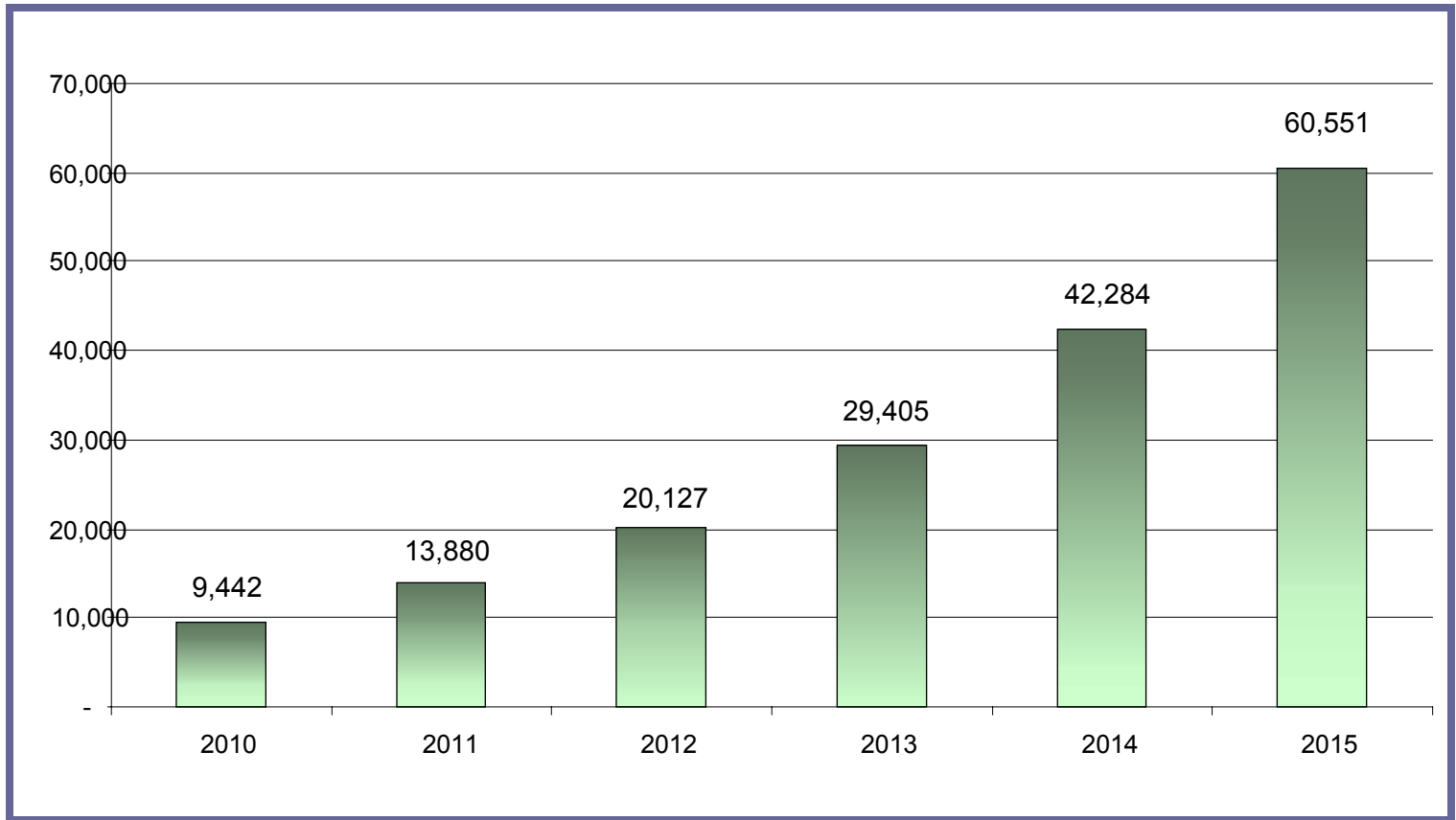
- Eddy current sheet resistance measurements on multi-crystalline wafers
- A discontinuity was seen in a wafer that was later seen to have a crack
- Photos courtesy of Lehighton Electronics

Solar Cells – Equipment Leaders

2009 Solar Equipment Market Shares - Top 11 Vendors



Huge Solar Cells Market Forecast in MW Per Year



Conclusions

- Niche markets offer an opportunity for small to mid-sized companies to compete against the large equipment and materials suppliers
- Niche markets offer greater growth potential than standard semiconductor devices
- A win-win situation