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## Reducing Semiconductor Material Waste by Cleaving for Wafer Manufacturing

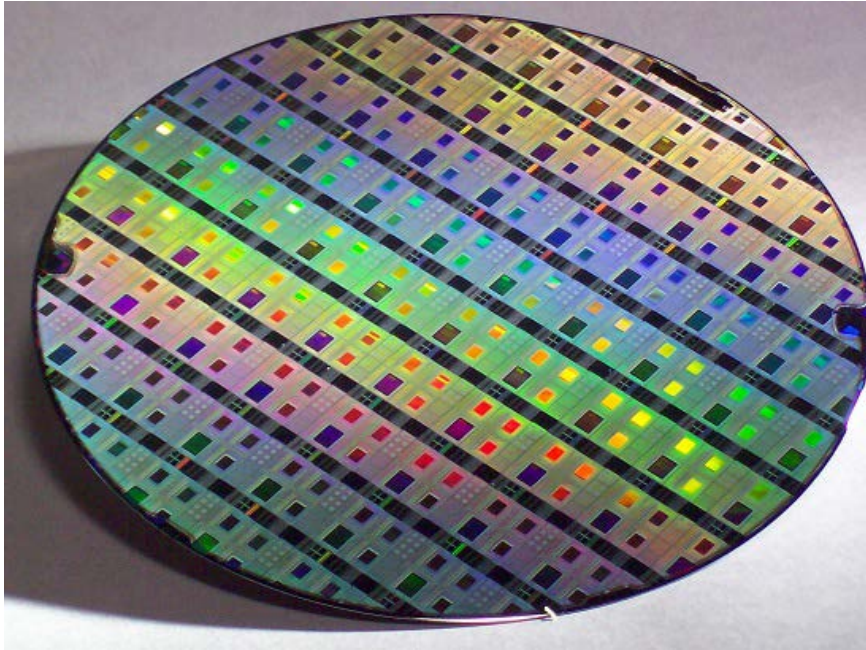
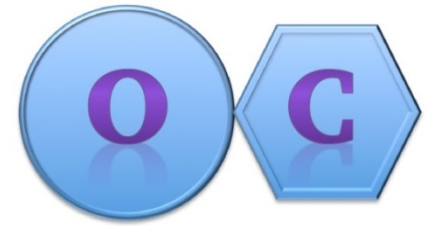
**John Farah**

CTO

**Jason Schmitt**

CEO

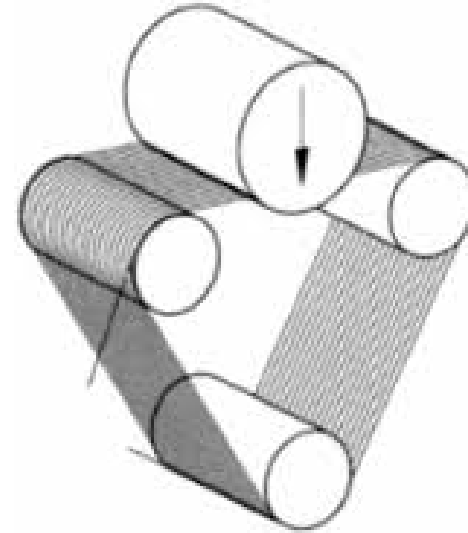
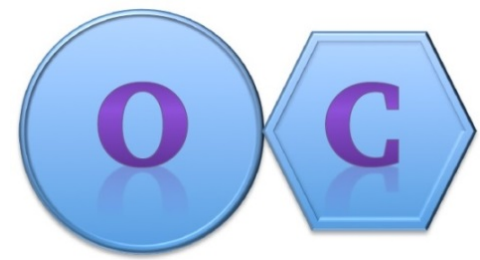
# Waste of semiconductor material due to wafering



**50% of usable material  
is turned to dust**

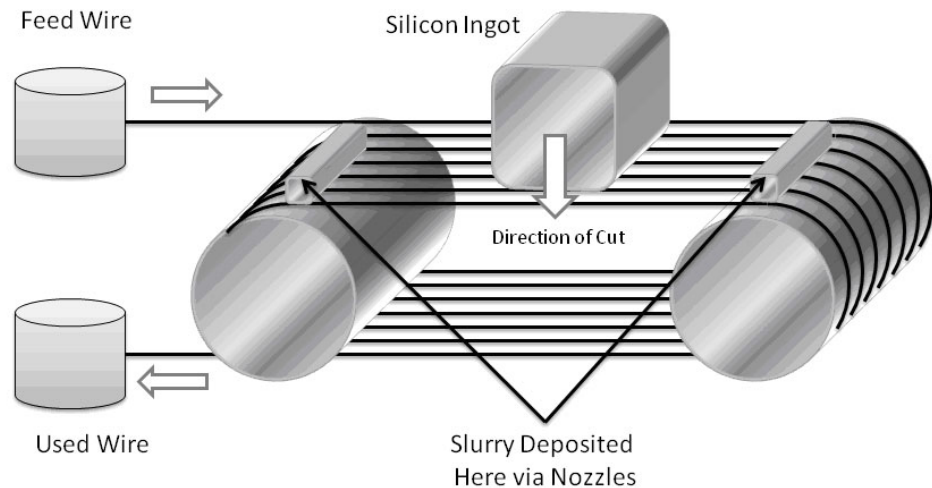


# Wire sawing

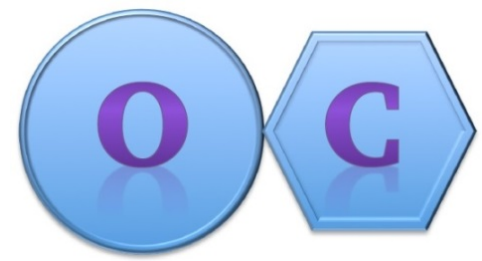


## Cost Categories:

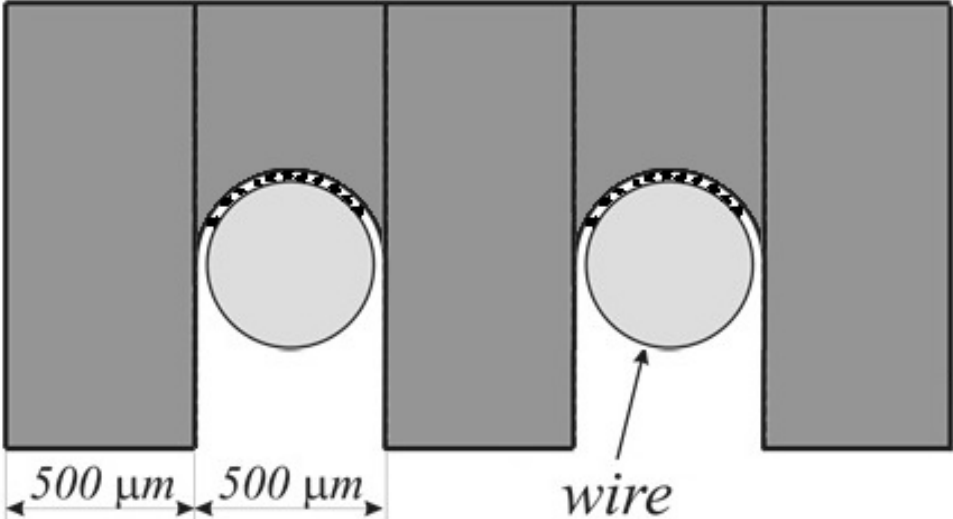
- Waste of material \$ 5 B
- Saw CAPEX \$ 1 M
- Diamond wire \$ 400/Km
- Time of wafering 8 hrs/4"



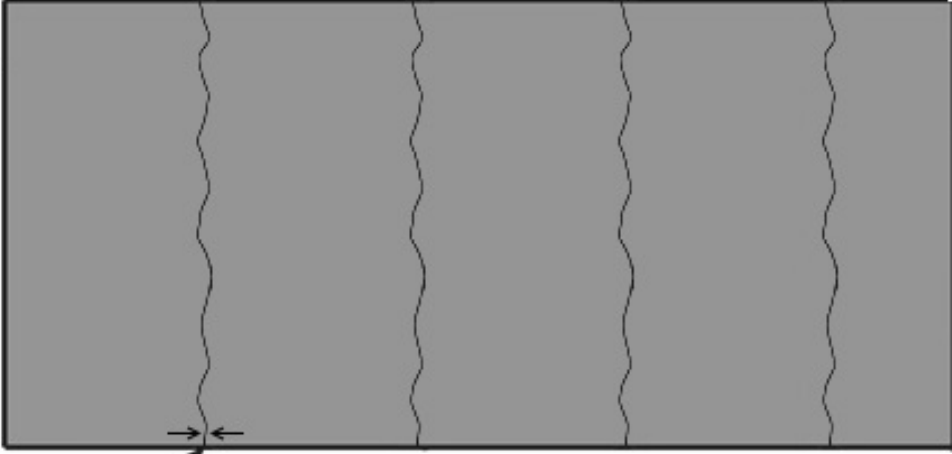
# Half of the ingot is lost



# OptiCOMP's crack approach



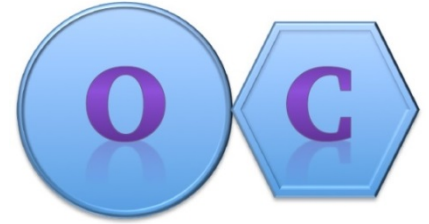
Wire Saw



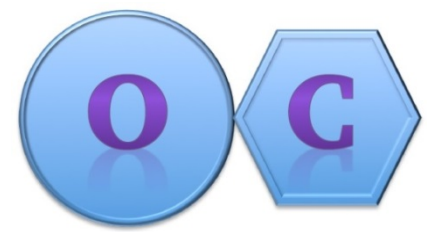
Crack



# Split SiC substrate in two without loss of material

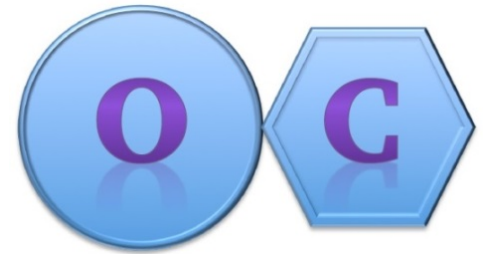


# Advantages



- materials loss reduced by 90%
- kerf loss reduced dramatically
- Throughput doubled
- crack much faster than sawing
- Big savings on CAPEX
- impact on US energy conversion and SSL

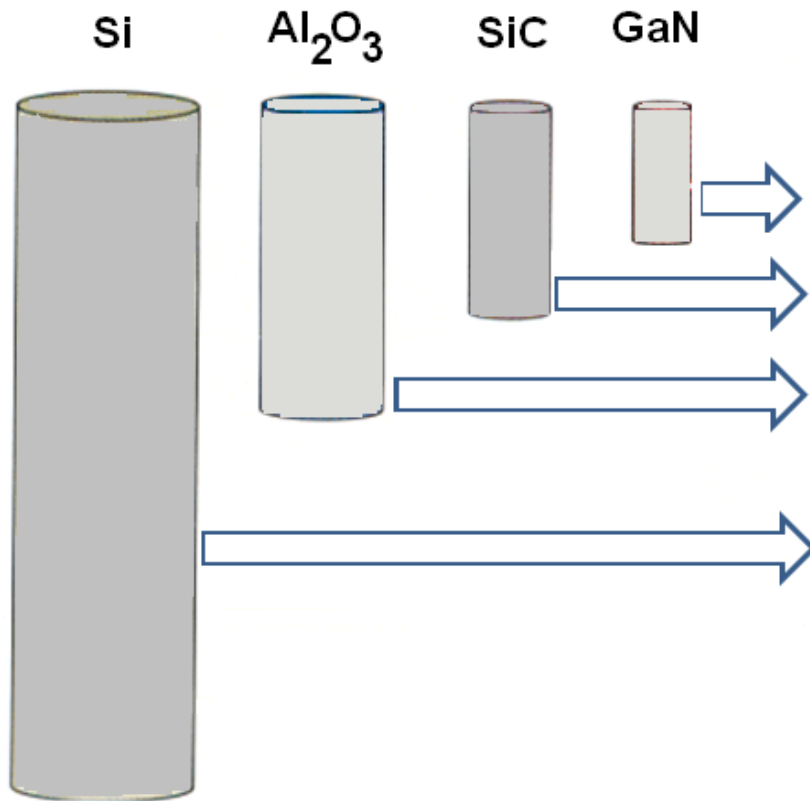
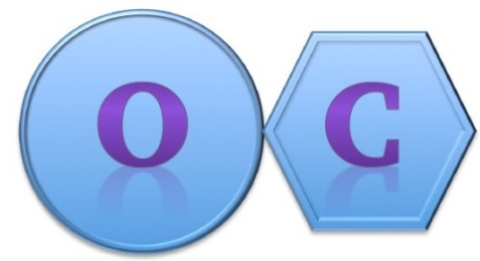
# Road map



- 1) SiC, GaN, AlN wide bandgap for clean energy
  - 2) Si, Sapphire
  - 3) Polycrystalline for photovoltaics and ceramics
- Reduce cost of manufacturing 2" GaN wafer by 2x, savings of \$ 1,500 per 2" wafer according to GaN wafer manufacturers
  - customers have indicated that it is a pain point
  - Widen cleaved area to  $20 \text{ cm}^2 = 2''$  wafer
  - Engage customers and investors

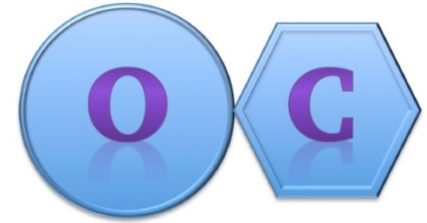


# Semiconductor wafers per ingot



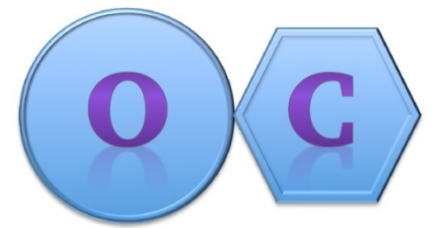
Wafers per ingot	Wafer price
< 10	x 100
< 50	x 30
< 100	x 10
>100	x 1




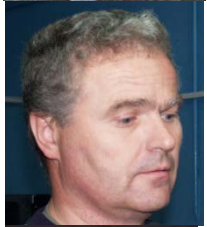

# Financing strategy & IP



- 5 companies want to license our technology
- Finalist in CEC Catalyst
- Academic consultants
- Business Advisors
- Seek Angel Investment
- SBIR
- Patent application on wafering pending
- Patent application on wafer thinning pending

# The Team



-  **John Farah** – PhD '89 in mechanical engineering from MIT
-  **Jason Schmitt** – Raised over \$ 10 M in private equity capital
-  PhD
-  PhD
-  **Bart Dillashaw** – Legal Adviser – Lawyer – Start up investor  
(President of the Nebraska Angel Networks)