Polar Sapphire
A Breakthrough Process for Making High Purity Alumina
About Us

• New process for manufacturing high purity aluminum oxide

• High Purity Alumina is used to manufacture LED substrates, ceramic battery separators, cover glass on phones and watches, and other smart phone parts such as camera lenses, home buttons, finger print buttons and heart rate sensors

• Proprietary process uses significantly less energy – thereby lowering capital and operating costs while improving product quality

• Located in Mississauga, Ontario, Canada
Comparison of High Purity Alumina Processes

Polar Sapphire Process
- 5N
- $6-10/kg
- Low energy
- Low capital
- No pollutants
- High purity
- High consistency
- High flexibility

Aluminium Alkoxide Hydrolysis Process (React with Alcohol)
- 5N
- $18-22/kg
- High energy input
- High capital costs
- Medium purity
- Low flexibility

Ammonium Al Sulfate Process (React with Ammonia)
- 4N
- $15-20/kg
- Low purity 4N
- SO_x pollutants
- Inconsistent and low purity
Market Predictions

• The global high-purity alumina market will grow at a **CAGR of over 27%** by 2020. Technavio

• High Purity Alumina Market to Reach **$6.41 Billion** by 2024. Grandviewresearch.com

• World High Purity Alumina Market is Expected to Reach **$4,498 Million** by 2022, registering a **CAGR of 16.7%**. www.marketwatch.com

• High Purity Alumina Market worth **5.09 Billion USD** by 2020. www.marketsandmarkets.com

• Global Market Study on High Purity Alumina (HPA): High Demand for LED's and Displays to Drive Growth During 2015-2021 ... **CAGR of 19.7%**. www.persistencemarketresearch.com

• We estimated the market size was about **$1 Billion in 2016**
Sapphire Material Consumption

2016 material consumption breakdown per application
(Excludes traditional watches, aerospace, defense, etc.)

Yole Development 2016
Ceramic Separators for Li-ion Batteries
Leadership Team

**Scott Nichol** CEO & CTO, experienced serial cleantech entrepreneur. Founded 6N Silicon, which developed and commercialized a new metallurgical process for purifying silicon for use in making solar cells.

**Dan Smith** VP of Operations, serial cleantech entrepreneur with experience scaling new technologies to production scale. Developed manufacturing process at 6N Silicon.

**Iman Zargaran** Senior R&D Scientist, experience working with and developing nano alumina powders for various applications. Masters in Materials Engineering.
Largest Sapphire Ingot Growers (Customers)

2015 vs 2014 sapphire revenue ranking

Revenue trends in $

- Rigidtech (TW)
- Aurora (CN)
- Monocrystal (RU)
- Namiki (JP)
- Crystalwise
- Kyocera (JP)
- Crystal Applied Technology (TW)
- Crystaland (CN)
- JeShine (CN)
- Hansol Technics (KR)

(Yole Développement, September 2016)
Competitors

- Sumitomo Chemical, 3,020
- Hebei Pengda, 3,000
- Zibo Xinfumeng, 2,500
- Xuancheng Jing Rui, 1,200
- Baikowski, 1,200
- Nippon Light Metal, 1,100
- Dalian Rall, 600
- Huantou, 800
- Others (15), 3,570
- Sasol, 1,800
Current Status

- We have just completed scale up to 400 kg/day alumina production capacity
- Capital cost of $5/kg of annual production capacity compared to $20-80/kg for our competitors’ processes
- We are sending samples to various potential customers over the next few months to qualify our alumina
- Our current cost is estimated at $10/kg on our pilot line and $6/kg in full scale production
- Various grades of high purity alumina sell for between $15-25/kg
Our Milestones

March 2013:
- Lab scale powder 1 kg batches

August 2013:
- 3.6 t/yr Pilot Line

August 2014:
- Less than <30 ppmw total impurities

Q2 2015:
- 90 t/yr capacity

Q4 2016:
- 140 t/yr capacity
- Qualifying with customers

Seed Funding $0.5M

A Round $3M

Grant $2.65M $1M loan

B Round $1.5M
Expansion

- We plan to build a production facility using our technology in near future
- 900 t/yr plant would require $4.5 million in capital
- 900 t will generate $18 million in revenue and $10 million in profit
- The 900 t/yr plant could be expanded to 5000 t/yr
THANK YOU!

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