OPTICAL TEMPERATURE MEASUREMENTS IN ELKEM

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Elkem AS:

- Founded in 1904
- Owned by China National Bluestar since 2011
- 110 years of history as a technology provider

- 3600 employees (of which 1350 in Norway)
- 24 plants world wide, headquarter in Oslo, Norway
- Global research centers in Kristiansand and Lyon, with 370 R&D workers
- NOK 14.5 bn revenue in 2015.
Elkem Technology, R&D Technical Center.
- All in one place - open to internal and external research projects -

1. Pilot Plant
2. Laboratories and Instrumentation
3. Bench Scale Testings /Hydrometallurgical Testings
4. Solar Pilot Plant
5. Offices
Test of optical sapphire contact thermometer in Elkem Solar solidification furnace
Test of optical sapphire contact thermometer in Elkem Solar solidification furnace
Test of pyrometer in quartz protection tube

- Open sapphire tube and quartz protection tube
- Non-focused lens

- Blackbody
  - SiC disc
  - Alsint disc
  - Empty

- Quartz tube
- Raytek 2-colour pyrometer
- Non-focused lens
Pyrometer «SigSimE» vs thermocouple type B

- Pyrometers: 2 Raytek 2-colour FR1 CSF003 with quartzs protection tubes.
- Thermocouple: 0,5 type B, alumina insulator, quartzs protection tubes.
- Surface detector
- All mounted at the same level
- Immersed in molten silicon at 1450°C
Permanent installation of SigSimE

- Installed at small induction furnace
- Replaces TC type «C» and dip lance
25.10.2016 Pyrometer test

- Raytek FR1CSF Handheld
- Type C

Temperature readings from 11:00 to 11:10 with a decrease in temperature over time.
Saint Gobain SiC test furnace

- Protection tube
  - Graphite (flushed with Ar)
  - SiC
- 2-color Raytek pyrometer
  - Marathon FR1C
  - 1000 – 2500 °C
  - 2-color bands:
    WB: 0.75 to 1.1 µm
    NB: 0.95 to 1.1 µm
- 2-color Lumasence pyrometer
- IMPAC ISQ 5-LO
- 1000 – 3000 °C
- 0.9 µm; 1.05 µm
Long-term stable Sapphire Fiber Bragg Grating sensors at 1400°C

• Tobias Habisreuther, IPHT Jena
• Katarina Grujic, Teknova

• Single crystalline sapphire fiber with diameter of 100μm an 1m length
• Air-clad fiber
• Two gratings multiplexed, 25cm apart
• 1400°C, 28 days
• ±2°K compared to type B thermocouple
ADVANCED MATERIALS
SHAPING THE FUTURE