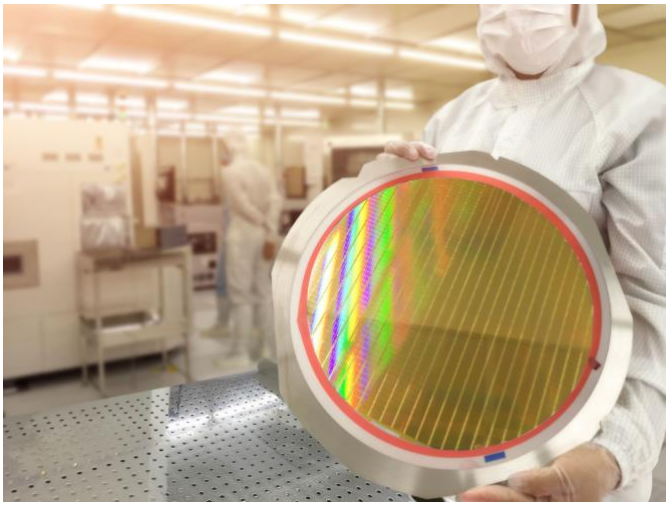
ilika | stereax
solid state batteries for the connected world

Application Note:
Solid State Batteries for Industrial IoT Sensor Wafers

Introduction

Silicon wafers form the basis of the semiconductor chips industry, and the market is set for growth. According to BBC Research, the global market for semiconductor wafers is expected to grow from $16.2 bn in 2018 to $21.3 bn in 2023. Whilst most people never actually see a silicon wafer, they are essential for manufacturing semiconductor microchips which are used in many everyday applications. For example:

- Smarphones
- Wearables
- Autonomous cars
- Consumer electronics



In order for the silicon wafers to be used they have to be ultra-clean – free of microparticles and any other impurities that will be detrimental to the performance of the sensor or micro-processors the chips will eventually be placed in. The process of turning silicon wafer into chips is by inserting and then depositing the wafers into growth chambers. When they come out, they are subjected to photolithography, etching, laser patterning, dicing etc to make chips.

In the growth chamber, parameters like temperature and pressure need to be accurately calibrated. To ensure this happens, a “sensor wafer” is placed in the chamber just before the real deposition takes place, at exacly the right location where the valuable silicon wafer will be placed minutes later.

This sensor wafer collects data about pressure and temperature which is then sent wirelessly back to the engineers operating the growth chamber so they can calibrate the deposition conditions. Alternatively, the data is saved in the memory chip on the wafer and downloaded once the sensor wafer is removed from the chamber.



Challenges

To operate the sensor wafer, it needs the right form of power. Challenges to overcome are:

- The chamber is hermetic so cabled power is impractical
- The temperature can go as high as 150°C, sometimes even higher
- As wafers are ultra thin (a few mm), the battery must also be ultra thin, typically around or less than 1 mm thick
- Vacuum level pressure means that any battery containing liquid solvents cannot be used

In summary, an appropriate source of power needs to be ultra-thin and be able to operate at high temperature in the low pressure environment of a growth chamber.

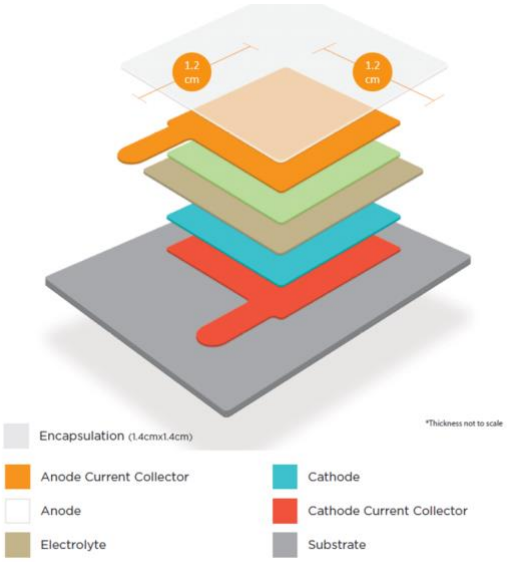
Ilika Technologies Ltd, Unit 10a The Quadrangle, Abbey Park Industrial Estate, Romsey, Hampshire SO51 9DL

Tel: +44 (0)23 8011 1400 | Email info@ilika.com | www.ilika.com | /ilika-plc | @ilikaplc

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Graphical representation of sensor wafer powered by Stereax solid state batteries

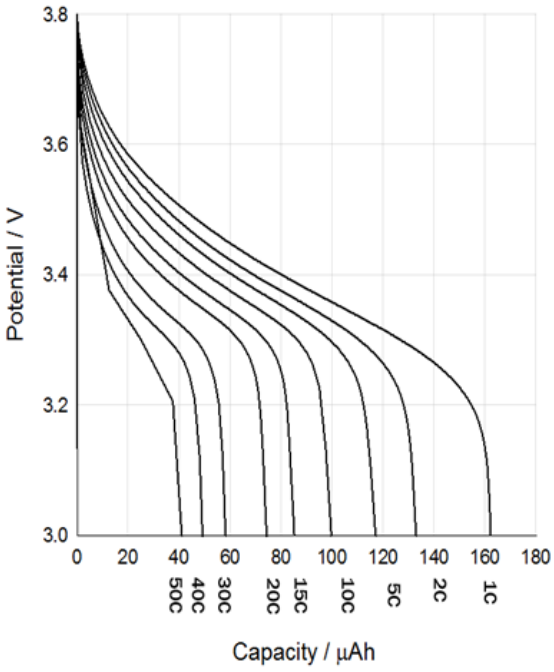


Representation of Stereax P180 solid state battery

Solutions offered by Stereax® Solid State Batteries

In solid state batteries (SSB), the flammable solvent found in lithium-ion batteries has been replaced by a solid electrolyte with a greater resistance to higher temperatures. With Ilika's innovative technology, the Stereax P180 can tolerate extreme temperatures to +150°C making it suitable for powering sensor wafers. In fact, we are currently working towards increasing the maximum temperature our batteries can operate at. Further benefits of our Stereax P180 batteries include:

- Miniature: <1mm thin
- Wide temperature range from -40°C to +150°C
- Capacity from 180 to 250 μAh
- Capable of storing energy harvested from the environment
- Safe, leakage free
- Resistant to high moisture and high vibration environments
- Long life: up to 10 years with thousands of cycles
- Customisable and scalable



Contact us for more info