ilika

stereax®
solid state batteries for the connected world

Stereax® P180 Frequently Asked Questions

Q: What is the operating temperature range of the batteries?

A: *The Stereax P180 can work between between -40°C and +150°C.*

Q: What is the capacity of the P180?

A: *Performance for the P180 varies with operating temperature. Above room temperature and up to 150°C, the P180 yields 180 µAh, whereas at the other end of the temperature scale, at -40°C, a capacity of 160 µAh is achieved.*

Q: Is the battery voltage similar to current lithium ion batteries?

A: *The output voltage for the Stereax P180 is 3.5V.*

Q: What are the differences between the P180 and the M250

A: *The P180 operates and can be stored at a wider range of temperatures, between -40°C and +150°C, as opposed to -20°C to +100°C for the Stereax M250. This was achieved by selected materials which protects the solid state battery in this wider range.*

Q: In what applications could the batteries be used?

A: *The size and performance of the Stereax P180 solid state battery make it ideal for applications in autonomous sensor devices in the Internet of Things (IoT). In particular, its performance at high temperatures (up to +150°C), make it appropriate to power end nodes situated near hot machinery or engines and exhausts in cars. At low temperature, such end nodes may be deployed to monitor infrastructure such as pipelines or bridges. For automotive applications, the Stereax P180 may store energy and combine with supercaps to power devices in cold mornings.*

Q: Can the Stereax battery technology power real devices now?

A: *To illustrate the ability of the Stereax P180 solid state battery to power real devices, Ilika has designed and constructed a demonstrator for high temperature applications. This device is a perpetual beacon for industrial or automotive applications. It is an autonomous sensing device of minimal size, which is powered by a combination of harvested solar energy from a high efficiency, indoor PV panel and the Stereax P180 solid state battery. The PV panel provides energy when solar energy is available (for example during the day) and keeps functioning when the solar energy becomes unavailable, by discharging the battery. The device may be placed in contact with hot surfaces of up to 105°C to replicate hot machinery or hot engine parts. A sensor measures temperature data which are transmitted through Bluetooth® to a tablet where temperature and battery characteristics (Voltage, State of Charge) are displayed.*

accelerated materials innovation

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Q: What materials are used in the batteries?

A: *The Stereax P180 batteries use similar cathodes to current lithium batteries, but uses different materials for the electrolyte and anode. The anode in the Stereax P180 is silicon. New materials were selected to enable the deployment of the P180 between -40°C and +150°C.*

Q: Are solid state batteries limited to the same cylindrical (prismatic) format as conventional batteries such as AA or AAA format?

A: *Solid state batteries are flat and the Stereax P180 batteries have a square footprint. The footprint can be adapted to suit the end device requirements.*

Q: How thin can a solid state battery be?

A: *The thickness is dependent on the thickness of the substrate. For the Stereax P180 battery, we use a standard 650 μm silicon substrate and the overall thickness of the battery is circa 1.0 mm. Tests are on-going to use other substrates, such as 200 μm glass.*

Q: These solid state batteries look great! Where can I purchase some?

A: *The Stereax technology platform is developed by Ilika, who licenses its IP portfolio and know-how to systems and components OEMs and manufacturers. This format allows Ilika to respond to partners' requirements more efficiently than manufacturing standardised product lines, for an optimal outcome and greater flexibility in terms of shape, capacity, life cycle, etc. The Stereax M250 and P180 are embodiments of Ilika's IP, which illustrates key technological developments achieved by Ilika.*

Q: Can Stereax solid state batteries be integrated with a micro-controller (MCU)?

A: *The size and form factor of the Stereax solid state batteries mean they are a good match for integration on chips or in MCU packages. The low temperature evaporation process is similar to that used for MEMS manufacture, for example.*

Q: What benefits do solid state batteries have over existing lithium ion batteries?

A: *The major benefits of solid state batteries derive from the solid electrolyte. Conventional lithium Ion batteries use an organic solvent, which is flammable and has a relatively short useful life.*

Performance benefits include:

- *Faster charging (6x faster).*
- *Increased energy density (2x energy for the same volume).*
- *Increased cycle life (up to 10 years, compared to 2).*
- *Low leakage currents (nano Amps).*
- *Non-flammability.*

Q: What is the scalability of the technology?

A: *Ilika's batteries can be scaled to larger footprints through production processes used to produce bulk glass and photo-voltaic sheets. This creates the potential for large area batteries.*

Q: How does Ilika's solid state battery differ from other solid state batteries?

A: *The main difference is the combination of materials. Other solid state batteries use "free lithium", which is highly reactive with moisture and air and hence require stringent encapsulation. In the Stereax P180, the lithium is not free during storage or cycling; it is "alloyed" in the cathode or anode and this reduces the encapsulation requirements.*

Q: Does Ilika have patents protecting this new technology?

A: *Ilika currently has six patent families which cover three main areas: the composition of the materials in the battery, the process to make the battery and the cell architecture of the battery.*

Q: Will Stereax battery technology ever be scaled-up large enough to provide motive power in electric vehicles?

A: *The materials used in Stereax batteries can be used in large scale battery packs like those needed for electric vehicles. However, Ilika is currently focused on micro-batteries for powering wireless sensors. These micro-batteries are made using Ilika's proprietary vapour deposition process. To be economically viable, larger batteries would probably need to be made using bulk powder processing techniques.*