Inactivation of HF in Li-Ion Batteries, EDLCs and Supercapacitors

Enhanced lifetime and safety through functional glass powders

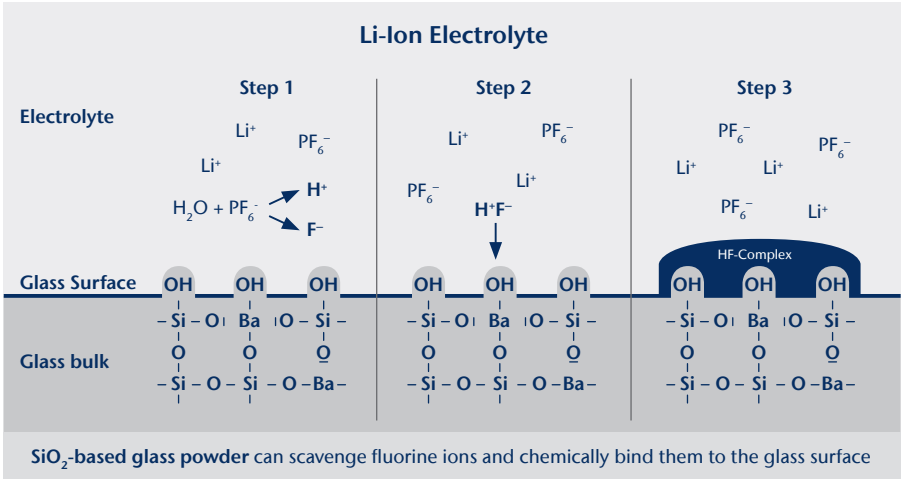
Hydrofluoric acid (HF) is responsible for degradation and a shortened lifetime in numerous energy storage devices that use fluorine-containing organic electrolytes, e.g. lithium-ion batteries. Even small amounts of residual moisture (e.g. introduced during battery production) often result in the formation of highly corrosive HF inside the battery cells, since flourine reacts violently with water. This affects the electrolyte chemistry, leading to lower performance, failure of the device, or in worst case outgassing and leakage of the electrolyte.

Product information

SCHOTT has developed a special Ba-silicate glass powder to absorb hydrofluoric acid. Due to its special composition, the inorganic glass particles can scavenge fluorine ions and chemically bind them to the particle surface. This binding is permanently inactivating and preventing the formation of hydrofluoric acid in the battery system.

Advantages of SCHOTT HF-scavenging glass powder

- **Significant increase of lifetime and safety of lithium-ion batteries, EDLCs and Supercaps (dependent on materials/chemicals used)**
- In case of thermal run-away, the glass powder particles remain in place and protect the electrodes from contacting each other, preventing a short circuit reaction when used on or in the separator.
- The world's first **inorganic** additive with HF-gettering function:
  - Chemically resistant to fluor containing electrolytes
  - Electrochemically stable even in high voltage applications
  - Temperature resistant up to several hundreds °C
  - Reduced abrasion in coating processes due to lower hardness in comparison to ceramic materials



SiO_2-based glass powder can scavenge fluorine ions and chemically bind them to the glass surface

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Material Data

		HF Scavenging Glass G018-405
Form of delivery/particle size		Glass powder with a mean particle size of 1µm or 0.7 µm (d50) and 90% of particles smaller than 5 µm (d90). Other grain sizes are available upon request.
Approx. specific surface area	m^2/g	
HF scavenging power	mg F^- / g glass	40 – 60
Coefficient of thermal expansion (-30 / +70 °C)	$10^{-6}/K$	10.1
Max. operation temperature (ISO 7884-8)	°C	> 600
Density	g/cm^3	4.1
Young's Modulus	GPa	68
Hardness (Knoop) HK0.1/20	–	440
Wettability with electrolyte (contact angle bulk)	°C	15-30
Residual water (Karl Fischer after drying 100 °C/4h/air)	mg/cm^3	6

Applications

SCHOTT's HF-gettering glass powder is suitable as an additive for the separator, the electrode materials, as a coating on electrode materials, or in the electrolyte in:

- Lithium-ion batteries
- Electric double layer capacitors (EDLC) or Supercapacitors
- It can also provide benefits for other applications, in which HF must be chemically bound

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