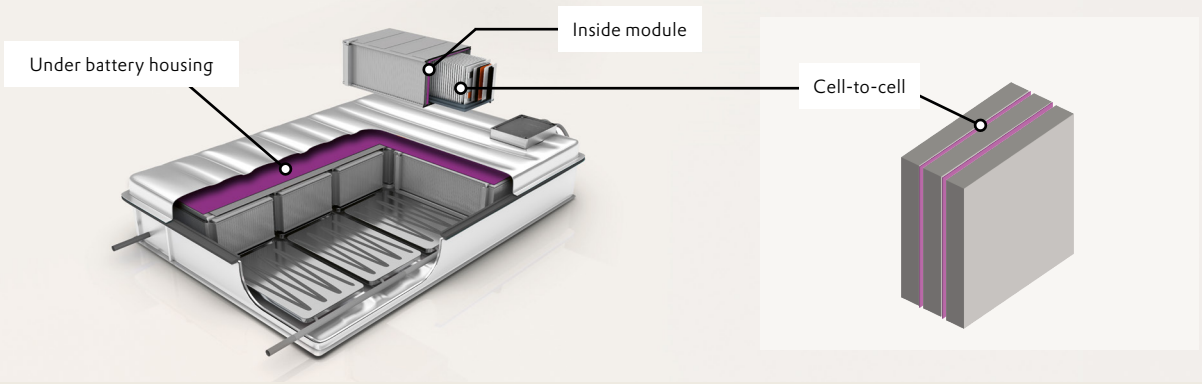
AEROSIL® and AEROXIDE® in EV Battery Thermal Protection & Insulation

Applications for AEROSIL®/AEROXIDE® containing thermal protection and insulation



Thermal insulation is an important aspect of electric vehicles (EVs) as it helps maintain temperature of the battery pack and other components. It can reduce the risk of the occurrence of a thermal runaway, which is the most detrimental safety issue in lithium-ion batteries (LIB).

AEROSIL® fumed silica and AEROXIDE® fumed aluminum oxide, as a type of nano-porous materials, have shown great potential in enhancing thermal insulation of LIBs in electric vehicles. By creating air pockets and scattering phonons in their porous structure, they can effectively reduce heat transfer. In addition, mechanical strength of insulation sheets made from fumed oxides can be further improved by incorporating fibers. Specific combinations of both materials can even further enhance thermal stability of the insulation sheets, making it a promising solution for EV battery design.

AEROSIL® & AEROXIDE® for EV battery thermal protection and insulation

Features

- Hydrophilic AEROSIL® & AEROXIDE® fumed oxides are fully inorganic and thus non-inflammable
- Low thermal conductivity, excellent thermal insulation
- Further increased thermal stability with Al_2O_3 containing AEROSIL® and AEROXIDE® grades

Benefits

- Enables thin design of insulation and protective layers
- Can reduce risk of thermal runaway of the battery
- Can offer improved safety for battery and passengers with Al_2O_3 containing AEROSIL® and AEROXIDE® grades

Thermal stability under different heat treatments

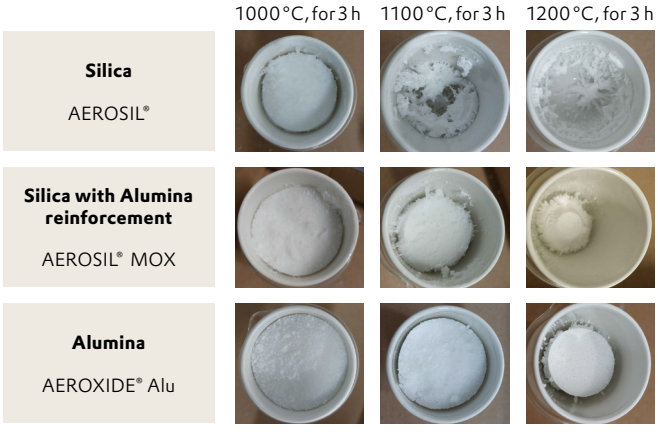


Figure 1

A low shrinkage of the inorganic particle network under high temperatures is an important feature to maintain the function of a thermal protection sheet. The AEROSIL® MOX shows less shrinkage under elevated temperature than the pure fumed silica. This can be explained by the alumina-reinforced structure of the MOX-grade. Pure AEROXIDE® alumina shows even less shrinkage, especially at 1200 °C.

Effect of calcination time

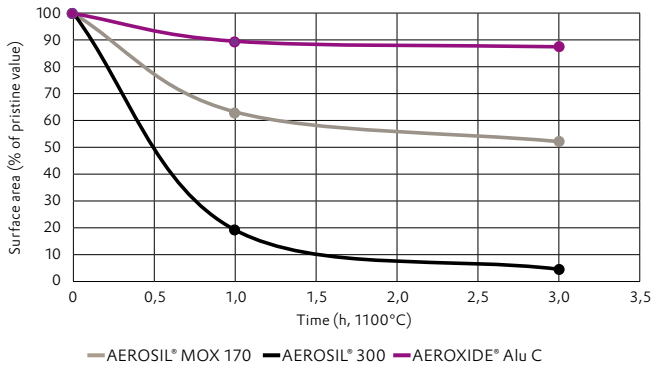


Figure 2 *shows the effect of calcination time on the normalized surface area of various fumed oxides. Whereas the fumed silica AEROSIL® 300 loses the surface area completely over time it is maintained on high level for AEROSIL® MOX 170 and AEROXIDE® Alu C. This indicates that Al_2O_3-containing fumed oxides will provide better thermal insulation at elevated temperatures as specific surface area and related fine pore structure is mostly maintained.*

Recommended AEROSIL® and AEROXIDE® products for EV thermal insulation applications

PRODUCT GROUP	BENEFIT	CHEMICAL COMPOSITION
AEROSIL® 200/AEROSIL® 300	Very low thermal conductivity, good thermal stability	SiO_2
AEROSIL® MOX 170	Very low thermal conductivity, increased thermal stability	SiO_2 with Al_2O_3
AEROXIDE® Alu C/AEROXIDE® Alu 130	Low thermal conductivity, further increased thermal stability	Al_2O_3

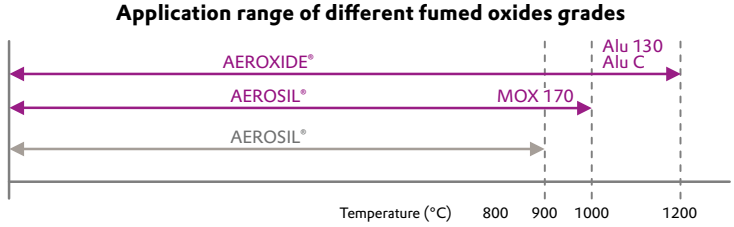


Figure 3 *Recommended AEROSIL® and AEROXIDE® products and preferred range of temperature for use.*

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