

Evaluation of the chemical safety of a NaS battery

The intrinsic safety of NGK's NaS battery system was comprehensively evaluated in a joint project conducted by BASF New Business GmbH, NGK Insulators and TÜV Rheinland Industrie Service GmbH as independent body.

The intrinsic safety assesses the risk with regard to the occurrence of a fire and/or a serious explosion and/or the release of hazardous quantities of SO₂.

In 2011, following the safety-relevant incidents, NGK implemented additional safety measures on a module and battery level. additional automated quality controls were introduced during cell production, the number of cells per module was reduced and additional fuses installed. The interconnection/wiring of the cells was changed so that in case of an internal short-circuit (e.g. due to leakage of conductive material from a cell) subsequent propagation with serious consequences can be reasonably ruled out. The additional safety measures implemented mean that the occurrence of incidents with consequences similar to those which occurred in 2011 and earlier (thermal run-away of complete modules, fires) can reasonably be excluded.

In addition, comprehensive safety tests conducted by NGK show that, due to the safety concept, the release of hazardous quantities of toxic SO₂ outside the battery enclosure can be reasonably excluded, even in the event of failure of several individual cells.

In essence, this joint evaluation has demonstrated that under practical conditions it is not possible to ignite an intact NGK NaS battery module (manufactured after 2011) or to trigger other dangerous scenarios from the outside or from within.

A list including the most relevant safety tests conducted by NGK can be found in Table 1. More detailed information is available upon request.

Table 1 Selected list with most relevant safety tests conducted by NGK Insulators.

Level	Safety Test	Result
Cell	Overcharge-breakdown test	No leakage of hazardous materials from cell
	External short-circuit test	No leakage of hazardous materials from cell
	Freeze-Thaw test	No leakage of hazardous materials from cell
Module	External short-circuit test	No leakage of hazardous materials from cells/module, fuses work
	Fire exposure test	No leakage of hazardous materials from cells/module
	Submerge test (water)	No leakage of hazardous materials from cells/module
	Test of self-extinguishing features	Fire does not spread within module after deliberate ignition of one cell.
	Drop test	No leakage of hazardous materials from cells/module
System	Test of self-extinguishing features	No leakage of solid reaction products from the container, only SO ₂ / smoke.
	Release of SO ₂	SO ₂ is released in case of deliberate ignition of one cell, but measured values remain far below IDLH limit.
	Drop test	No leakage of hazardous materials