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SAFE LANDING HEDGED: DRY CLOUD TECHNOLOGY FOR AVIATION SAFETY- THE NEW WAY ? - LITHIUM-ION BATTERIES ARE SAFE!

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PACKAGING TECHNOLOGY DEMONSTRATION 24 OCTOBER 2015- TECHNICAL INFORMATION PANEL MEMBERS



www.icao.int/safety/DangerousGoods

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- ▶ Introduction
- ▶ Basics
- ▶ Application

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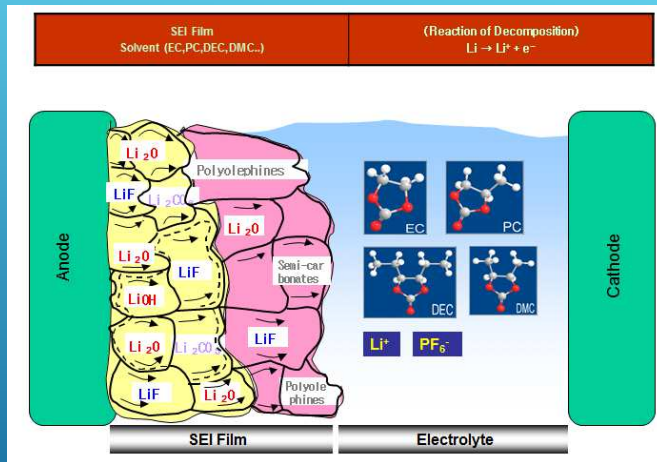
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This Dry Cloud introduction presentation is very basic one, (draft version) provide help for complying with legal or normative specifications, but do not replace them. The foregoing information was compiled to the best of our knowledge and belief. We cannot accept, however, responsibility for any error or omission, nor for any consequential loss or damage so arising. The instruction does not represent any guarantee of properties. Distributors and users of the product have their own responsibility for observing applicable laws and regulations or norms.

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Source: With special thanks to Roland Kim /Seoul

A look inside a LB or LIB cell... & market.

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- ✓ E-mobility will penetrate the market 2017 ff. ? Today 6 Billion cells shipped, even more...
- ✓ New high class quality.safety, QSP, safety devices, systems, very low field failures rate expected. For reference: Endcontrol process of Tesla for Panasonic Lithium-Ion Cells.
- ✓ High level of dg process .
- ✓ Well qualified and tested.
- ✓ New cells 20-23 instaed of 18650,
- ✓ New systems,
- ✓ New cell & battery desing-in,
- ✓ 300-500 km range of EV,
- ✓ - 50 Kwh in a passenger car..?

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- ▶ Jet flames,
- ▶ Dangerous heat,
- ▶ HF Phase,
- ▶ Massive smoke, fast, DANGER! H2...
- ▶ Long duration of fire: 13s25Ah roughly 1 hour, and more?
- ▶ Propagation issue,
- ▶ High fire load...

THE DRY CLOUD WILL COVER AND MANAGE ALL HAZARDS IN EVENT, NOTHING COMES OUT IF DESIGNEND WELL!

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Innovative Process Dry Cloud: EN Norm or NFPA compliance.
(DIN/EN13565-2 as example)



- 600 x foaming
- > 1.200 °C
- Strong stick effect.
- 9 hours stable
- Easy installation, not much costs overall
- Environment clean material
- All risks covered in Dry Cloud



✓ We follow the Initiative of Mr. Elon Musk of Tesla!



Foam Dry Cloud example. Source IB Knopf Berlin

FROM SMOKE TO DRY CLOUD- PRESSURELESS: STABLE FOAM > 8 HOURS. FOR HIGH FIRE LOADS LIKE LITHIUMBATTERIES. PATENT GRANTED IN GERMANY, INTERNATIONAL PCT/EP IN PROCESS...

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Specific Risk/Hazard	Dry Cloud
Jet flames	Strong suppression - no longer perceptible.
Fire	Strong suppression and cooling, stop the propagation effect, reduce the event on minimum: fast and efficient.
Smoke & Pressure	Since smoke is transferred into dry cloud material (solid), sustainable foam. No pressure!
HF- H2 – others , Can be breathed?	Tbd one step to neutralize /Inhibitor- no danger! No restriction on breathing, no dangerous heat (outside containment).
Ignition of explosive gas mixtures / Backfire in the flue gas/Explosion	No free Gas, not possible. No open fire.
Environmental hazard in cleaning or disposal	Material itself is not environmentally dangerous, after the event some used material shall be special waste, in the EU regs no problem to handle.
How long does it works?	It is an engineered solution, for certain application you find normal inspection regime for, durable and returnable for many years. Dry Cloud ist stable still Happy Landing.

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SPECIFIC HAZARDS VS. DRY CLOUD



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- ▶ We innovate solutions for storage,large battery, large battery (HEV,EV)
- ▶ We develope (and looking for partners) ULD Unit load device for Aviation safety purpose, we are able to deliver solution and small series beginning of **2016** if demanded.
- ▶ We develope small Dry Cloud solution for smaller batteries as well (CCC-application),
- ▶ We develope production and sales as far the market will demand Dry Cloud.



As mobile solution we offer container, f.i. for storage, ESS & EV !

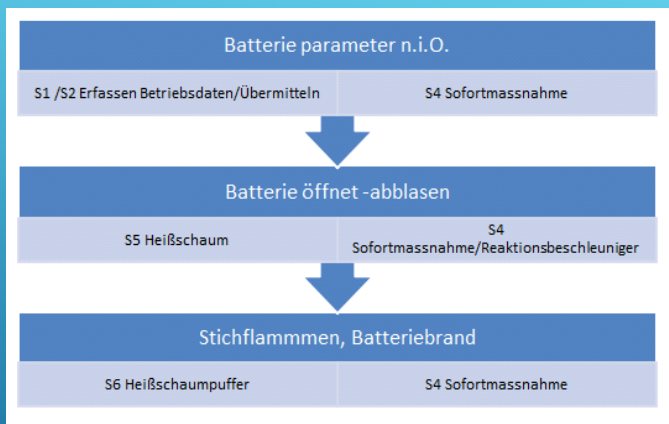


STATUS OF DELIVERIES DRY CLOUD FOR LITHIUM BATTERIES.

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S4 – Neutralizing HF and comprehensive integration of respiratory toxins, no propagation.

S5 - Dry Cloud itself. -1400°C.

S4 + S5 Again S4 + Reaction Accelerator + Inhibitor option.

S6 – Jet Flames, dangerous heat: Dry Cloud stable buffering, long lasting (reaction time of event could be significant)

S4 - immediate measure to adress & to eliminate residual hazard

Dry cloud will react to an event redundant and on the principle of safety first.

EXAMPLE DRY CLOUD PROCESS- PREDICATIVE PROCESS RECOMMENDED BY ENVITES ENERGY! DRY CLOUD WILL FLEXIBLE RESPOND TO THE EVENT, SAFETY FIRST!

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PCT/EP2015/070885 and another 2 IP families (granted DPMA)

- ▶ We are currently in the situation of the IP/ patent generation, thus we do have granted rights from Germany (German initial small patents) already,
- ▶ Dry Cloud is also in new patent family in PCT/EU, will beeing published in beginning of 2016,
- ▶ As I as the owner and inventor will herewith declare: basically we will support and transfer to serious condition the technology and our solutions to shorten time to market,
- ▶ EV, HEV, Railway, Aviation, Military and stationary applications as well...

*Not at least:
We follow
Mr. Elon
Musk
of Tesla's
initiative!*

DRY CLOUD IS OPEN FOR COOPERATION IN ORDER TO DEVELOPE THE SAFETY: TIM SCHÄFER (OWNER AND INVENTOR / ENVITES ENERGY). DRY CLOUD FOR THE SAFE LITHIUM-ION BATTERY.

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- ▶ 1. Safe Landing!
- ▶ 2. No stress. (8-9... hours or more stable)
- ▶ 3. Dry Cloud can be removed with e.g. ex-based vacuum cleaner, then prepared for collection/recycling.
- ▶ 4. Containment and the Dry Cloud equipment can be reused.

The Dry Cloud waste material is collectable waste materiel in the EU.

The Dry Cloud process material itself is not dangerous or environmentally harmful!

**DRY CLOUD: THE END OF THE EVENT? WHAT HAPPEN?
IS THE MATERIAL DANGEROUS? LITHIUM-ION
BATTERIES ARE SAFE.**

For development purposes we applied for subsidy (BMBF Federal Research Ministry of Germany). As we are plannig to carry out a number of retests including documentation at ZSW- Ulm.

DLH Cargo– The German airline Lufthansa Cargo expert will be invited, the Authority of Germany and the US FAA .

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