

IUMI WEBINAR

(E)Vehicle fires – what's true and what isn't?

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- PhD, Chalmers University of Technology
- Joined RISE 2021
- Lion Fire I and II, LASH FIRE, BREND
- ETOX-2




RI.
SE

Research Institutes of Sweden

- Non-profit, 3 000 employees
- Department of Fire and Safety
- Test facilities in Sweden and Norway




BORÅS



**Large fire hall in
Borås, Sweden**

**18 m x 22 m x 19 m
HRR up to 15 MW**



New facilities for battery testing

Gothenburg 2023:
Heavy and light vehicles

Electric powertrain
Full scale vehicles

Nykvarn 2023:
Heavy vehicles

Electric powertrain
Hybrid transmission

Borås 2023:
Safety tests

Abuse cycling and cycling while
Climate, Vibration, Mechanical,
and Fire abuse testing



SEEL

SEEL Swedish Electric Transport Laboratory, är en del av RISE –
Research Institutes of Sweden och Chalmers University of Technology.

CHALMERS

RI
SE

Autoweek News • Industry News **News** **Racing** **Car Life** **Opinion** **Podcasts**

Felicity Ace Fire is Out But Why Do Car Carriers Have So Much Trouble?

There have been eight major incidents since 2002, half of them capsizings.

BY MARK VAUGHN • FEB 25, 2022



AFTONBLADEN TORSDAG 17 MARS 2022
Regioner: Norra, Centrala

START SPORT NOJE PLUS TV TIPSÅ KULTUR LEDARE

Schibsted **Brand hos Tesla – sju bilar i lågor**

Av Hans Osterman

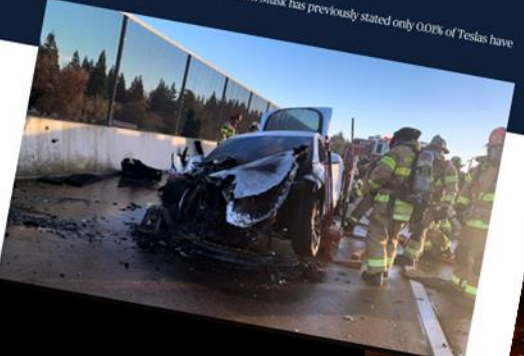
NYHETER
Branden på Teslas parkering började strax efter 01 under natten mot tisdagen.
Sju bilar på en yta av mer än 300 kvadratmeter stod i lågor när räddningstjänsten kom fram.
Polisen undersöker nu om gärningsmännen kan ha fastnat på övervaka.



NEWS POLITICS U.S. NEWS WORLD CULTURE AND TRENDS HEALTH BUSINESS TECH INDUSTRY TITLINE WATCH NOW

Tesla car battery 'spontaneously' catches fire on California freeway, requiring 6,000 gallons of water to put it out

No injuries were reported. Tesla CEO Elon Musk has previously stated only 0.01% of Teslas have ever caught fire.



BURNING EYES

ELECTRIC CARS HAVE ONE PROBLEM: THEY KEEP LIGHTING PEOPLE'S HOUSES ON FIRE

"IF WE HAD LIVED UPSTAIRS IN THIS HOUSE WE'D BE DEAD."





28 JUNE 2023
PULA, CROATIA

CFIS 2023
CONFERENCE ON
FIRE SAFETY AT SEA

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Make your registration for CFIS 2023 here!

LASH FIRE

www.lashfire.eu

LASH FIRE is an international research project aiming to significantly reduce the risk of fires on board ro-ro ships. The project is running from September 2019 to August 2023.

Facts and Myths About Fires in Battery Electric Vehicles



LASH FIRE Facts & Myths

As new energy carriers make their way into the market, some misconceptions will naturally also make their way to the public. The objective of this report is to respond to some of the most common misconceptions and myths regarding battery electric vehicle fires, while highlighting the latest research and available data.

Read our 2-pager [here](#).
Read the full report [here](#).



Short introduction to the LASH FIRE project

For a quick overview of the project and its objective, watch our short introduction animation [here](#). (2 minutes)



"It's kind of a future thing"

For the development of a centralized fire resource management center (FRMC), our researchers from Sasemar, NSR, NTNU and RISE have accompanied fire drills on Stena ferries to study crew procedures and actions on board. Learn more about the development of the FRMC in our new [video](#).

Funded by



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 814975

Common statements when EV fires are discussed:



”EV fires are more common than ICEV fires”

”Ageing of EVs will increase the fire risk”

”EV fires are more intense than ICEV fires”

”Jet-flames will increase the fire spread”

”The fire effluents from EV fires are worse than for ICEV fires”

”You can get electrocuted whilst extinguishing EV fires”

”Charging lithium-ion batteries will increase the risk of fire”

EV – Electric Vehicle

ICEV – Internal Combustion
Engine Vehicle

– what’s true and what isn’t?

Are EV fires more common than ICEV fires?

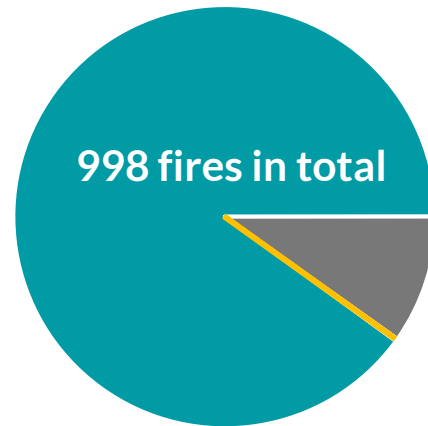
Fires per 1.6 billion km travelled

Number of fires

| Type | Fires/ 100k vehicles | Total fires |
|------------------|----------------------|-------------|
| Petrol/diesel | 1 500 | 200 000 |
| Battery electric | 25 | 50 |

Data on car fires from the NTSB (Nov 2022), vehicle sales data from the BTS. <https://www.carsmetric.com/electric-car-fire-statistics/>

Vehicle fires in Norwegian car parks and garages 2016-2018



■ Total ■ Fire started in electrical equipment ■ BEV

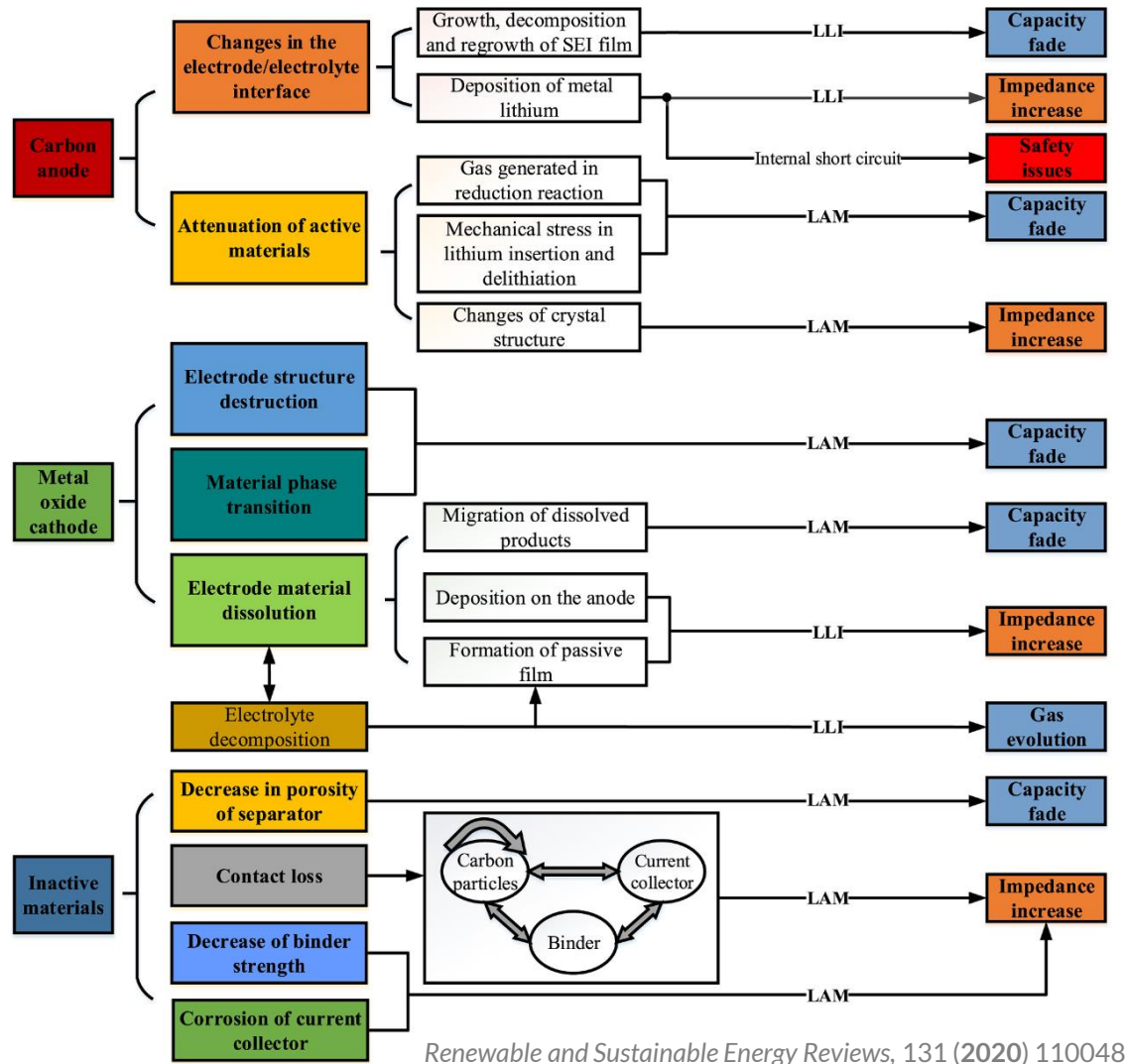
BEV
5

ICEV
55

Data source: "Myths and facts about fires in battery electric vehicles", 2022, https://lashfire.eu/media/2022/09/2022-08_Facts_and_Myths.pdf

Why vehicle fires?

- Arson
- Engine compartment
- Overheated brakes

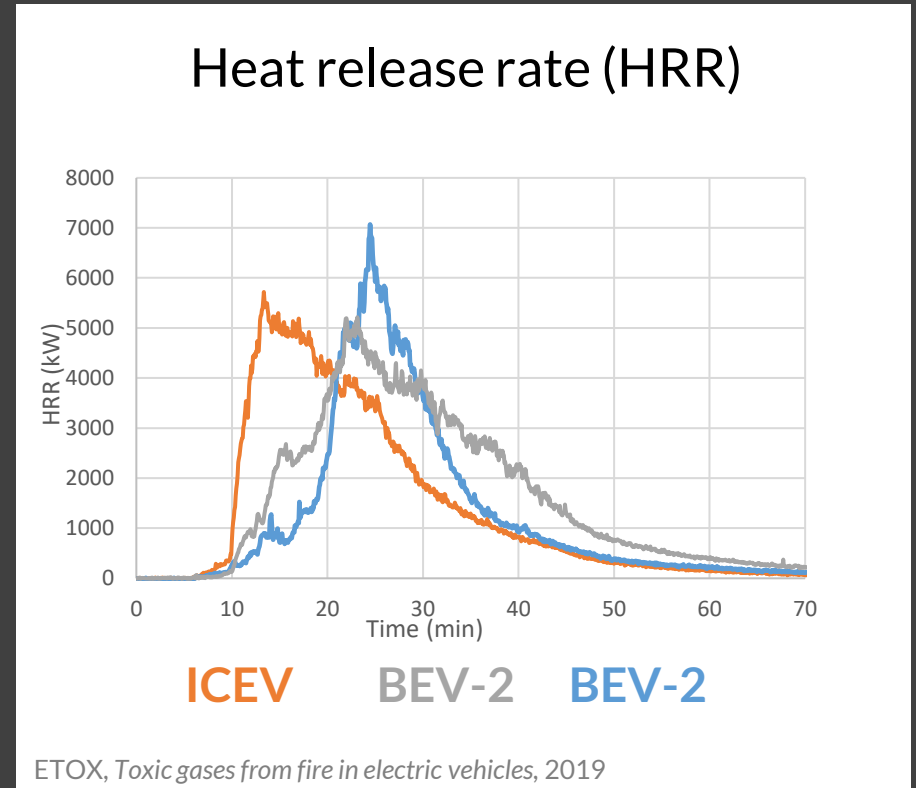
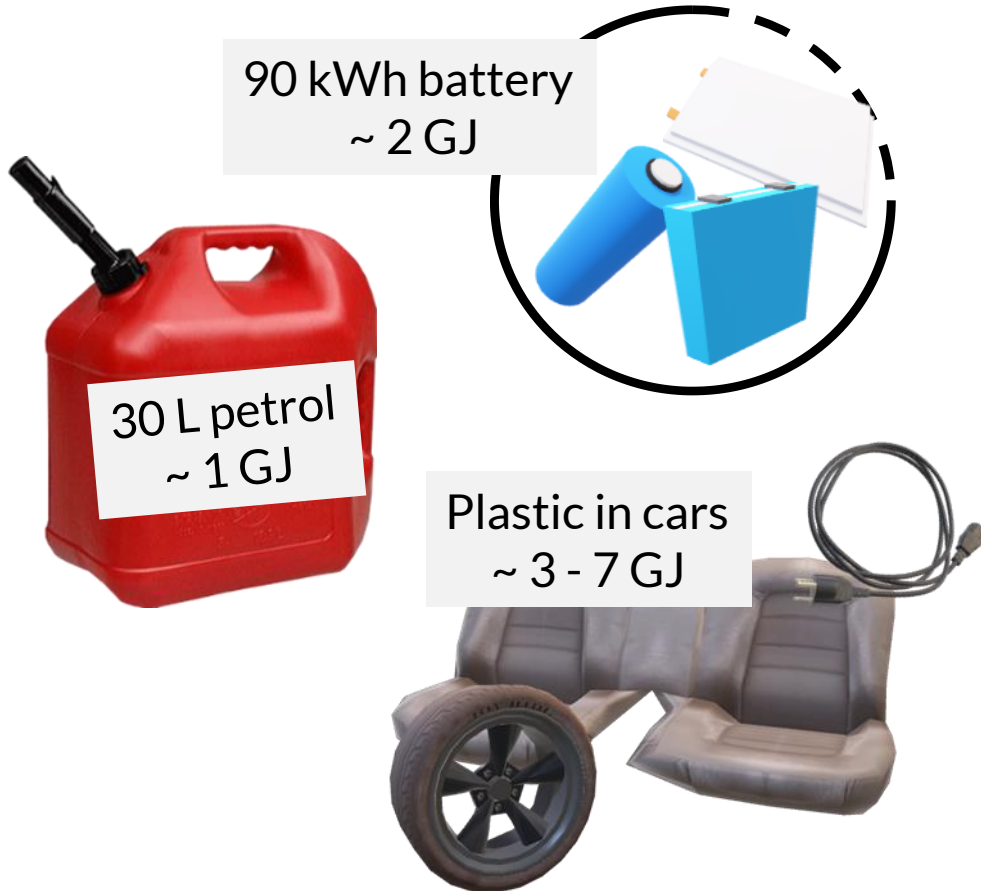


Renewable and Sustainable Energy Reviews, 131 (2020) 110048

Will ageing of EVs increase the fire risk?

- Ageing
 - Physical and chemical reactions inside of the cell
- Two main modes
 - Loss of Lithium Inventory (LLI)
 - Loss of Active Material (LAM)
- Complicated to model
- EVs SOH 70-80%

Are EV fires more intense than ICEV fires?



Will jet-flames increase the fire spread?

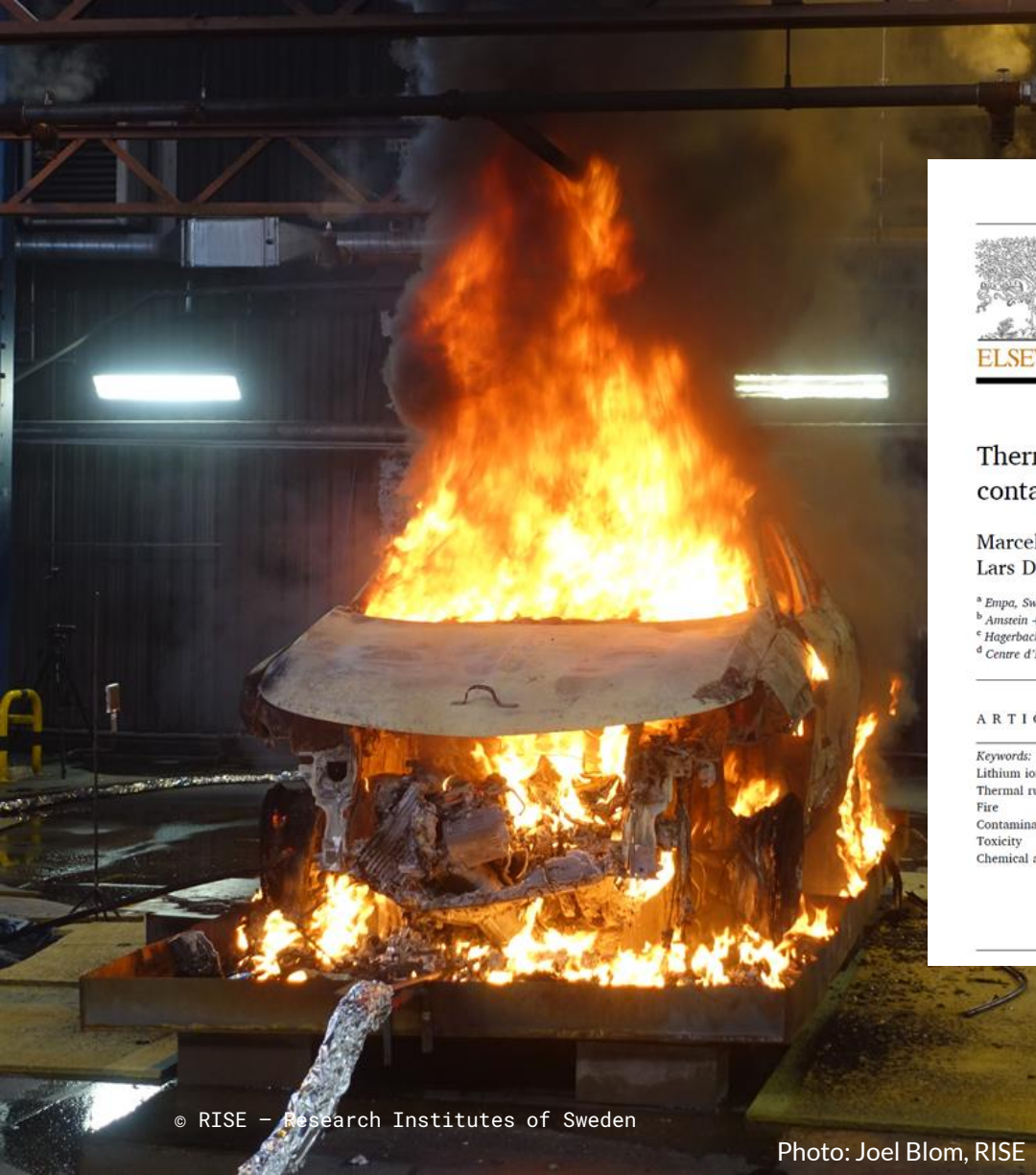
What determines the fire spread?

- Distance between objects
- Heat radiation
- Point of ignition
- Petrol vs battery





**Are fire effluents
from EV fires
worse than
effluents from
ICEV fires?**



Thermal runaway and fire of electric vehicle lithium-ion battery and contamination of infrastructure facility

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ARTICLE INFO

Keywords:

Lithium ion battery
Thermal runaway
Fire
Contamination
Toxicity
Chemical analysis

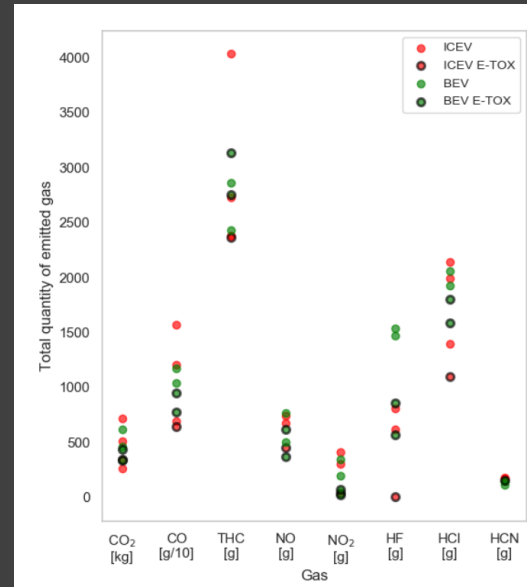
ABSTRACT

Thermal runaway and the subsequent fire of electric vehicle lithium-ion batteries cause a specific type of contamination. In order to assess the resulting risks of damage to critical infrastructure and to human health, we perform practical thermal runaway experiments with lithium-ion battery modules of an approved, commercially available electric vehicle. Extensive chemical analyses identify and quantify the soot depositions in ventilated and non-ventilated rooms. Contamination mainly consists of the metal oxides of the cathode material, lithium and fluoride compounds. Their influence on surfaces, protective textiles as well as their corrosiveness to typical metals and the impairment of electrical and electronic devices is low. The analysis of sprinkling and cooling water shows the necessary extent of its decontamination. Recommendations include preventive and mitigating measures for the appropriate handling of contamination caused by fires from lithium-ion battery powered electric vehicles.

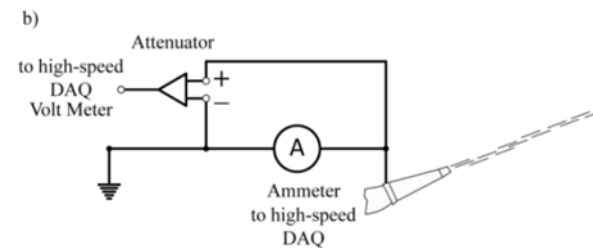
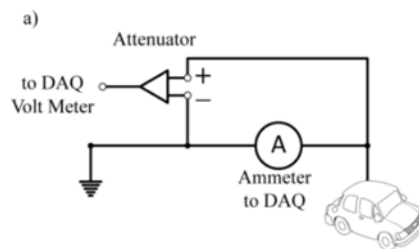
Hydrogen Fluoride

- Hydrogen fluoride
 - solution
 - gaseous
- Swedish Defence Research Agency (FOI) tests
- ICEVs vs BEV
 - toxic gas emissions

ETOX, Toxic gases from fire in electric vehicles, 2019



Can you can get electrocuted whilst extinguishing an EV fire?



Long, T. R. et al., *Best Practices for Emergency Response to Incidents Involving Electric Vehicles Battery Hazards: A Report on Full-Scale Testing Results*; 2013, NFPA

30 Ah, NCA, pouch cell



Photo: Mattijs van de Wiel - NOS

Will charging of lithium-ion batteries increase the risk of fire?

- Charging of cells vs vehicles
- Battery management system (BMS)
- Use dedicated equipment



Summary

- EV fires are not more common than ICEV fires
- The effect of ageing is hard to predict (SOH is monitored)
- EV fires are not more intense than ICEV fires
- The fire effluents obtained from ICEVs and EVs are highly toxic
- The effect of jet-flames on fire spread has not been investigated
- Over-charging battery cells will increase the risk of fire.
However, EVs have a BMS that will hinder over-charging.
- All vehicle fires are dangerous, risks are different between ICEVs and EVs

Thank you for your attention!

ETOX and ETOX 2



LASH FIRE



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814975

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