Title:

The Use of eNose technology for detection of toxic fumes in electric vehicles.

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Topic:

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Abstract:

The increasing prevalence of electric vehicles (EVs) in urban and residential areas, as part of the global push for sustainable transportation, has raised concerns about potential hazards, particularly in the event of vehicle fires. This study presents the experimental setup and analysis of a field trial, focusing on identifying toxic gases released from EVs during fires, with the aim of informing the development of enhanced electronic nose (eNose) sensors for early detection and alert of such incidents.

In this study, an EV was intentionally ignited to simulate the toxic gas emissions resulting from a vehicular fire incident. Two sets of eNose device equipped with chemical sensors for particulate matters, carbon monoxide, volatile organic compound, hydrogen sulfide, and formaldehyde, were deployed to capture the emitted hazardous gases. Furthermore, air sampling was conducted for subsequent laboratory analysis of the toxic gas mixture. The eNose and air sampling units were positioned approximately 20m from the burning EV, and the outdoor experiment lasted for close to 1 hour. An anemometer was used to monitor wind conditions prior to and during the outdoor experiment.

The eNose and air sampling data indicated heightened concentrations of phosgene, hydrazine, formaldehyde, methane, and carbon monoxide, along with other hazardous gases during the trial. Notably, phosgene, hydrazine, and hydrogen sulfide exceeded the Acute Exposure Guideline Levels (AEGL) 1. While the eNose effectively detected increased levels of formaldehyde and hydrogen sulfide, additional air sampling and laboratory analysis were necessary to identify other crucial hazardous gases, such as phosgene and methane. These hazardous gases present significant risks to individuals, particularly in enclosed environments like road tunnels or underground carparks.

This study provides valuable insights into the toxic gas emissions from EV fires, serving as a foundational step towards the development of advanced eNose sensors for the early detection and alert of such incidents, thereby advancing the safety and security of EV use.