Researchers monitor thermal runaway of lithium-ion cells using optical fibers

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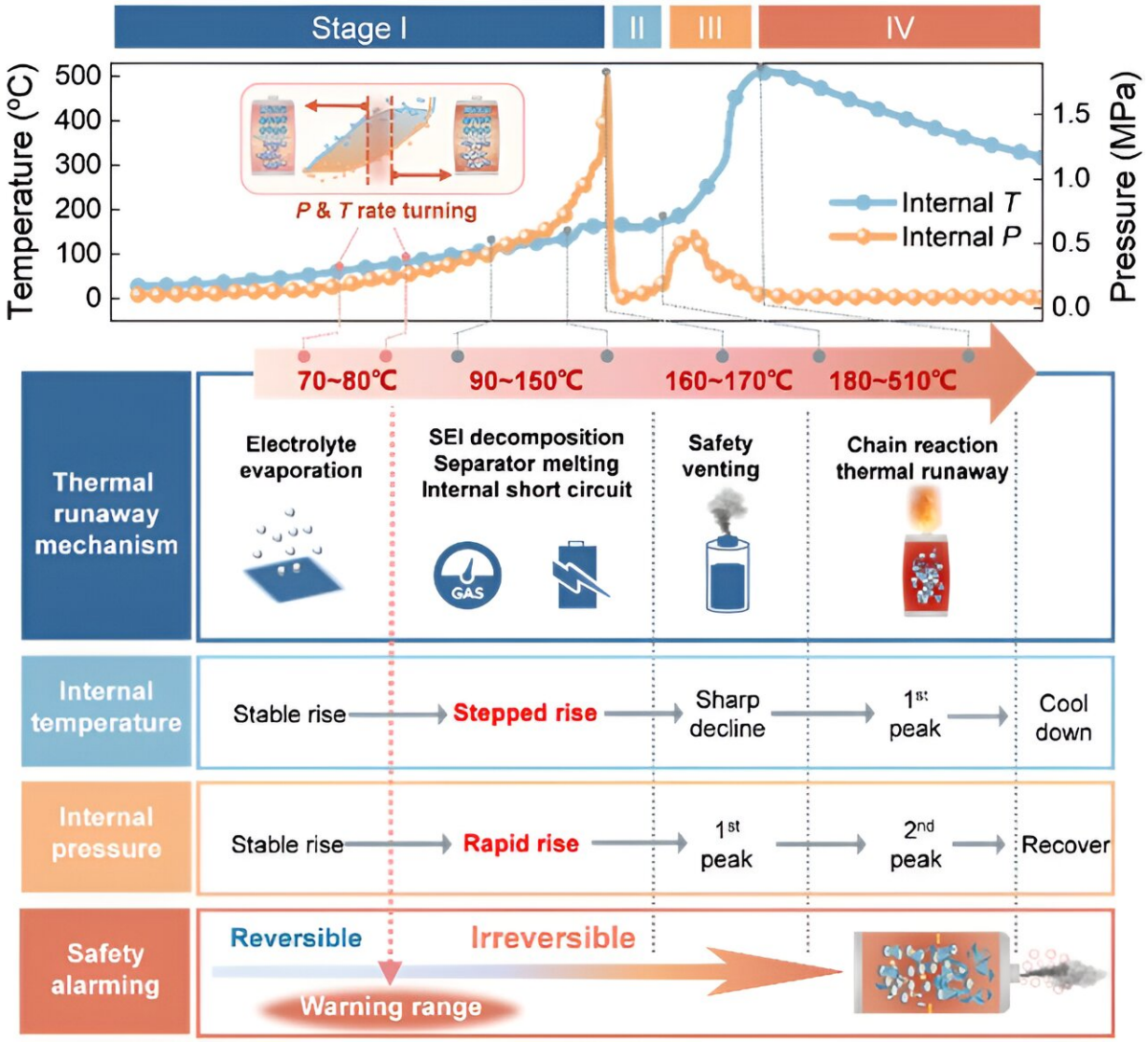

Establishment of internal characteristics and early warning intervals for thermal runaway of batteries. Credit: Prof. Wang et al.

Recently, a team led by Prof. Sun Jinhua and Prof. Wang Qingsong from the University of Science and Technology of China (USTC) of the Chinese Academy of Sciences (CAS), in collaboration with Prof. Guo Tuan from Jinan University, realized early warning of thermal runaway detection of lithium-ion batteries by optical fibers.

The study was published in *Nature Communications* titled "Operando monitoring of thermal runaway in commercial lithium-ion cells via advanced lab-on-fiber technologies."

As a sustainable energy storage device, lithium-ion batteries have been utilized worldwide. Nevertheless, recurrent fire safety incidents have become a serious source of concern impacting their further development.

The root cause of thermal runaway is a series of exothermic chain reactions within the battery. From local short-circuit to large-area short-circuit, the internal temperature of the battery rises rapidly, reaching 800℃ or more, triggering the fire and explosion of the battery.

Therefore, how to scientifically and accurately predict battery safety risks in a timely manner has become an international scientific challenge in the field of battery safety.

To overcome this problem, the team proposed a compact and multifunctional optical fiber sensor that can be implanted inside the battery to accurately analyze the whole process of thermal runaway of commercial lithium batteries and early warning.

The joint team has designed and successfully developed a compact and multifunctional optical fiber sensor that can work under high

temperatures of 1000°C and high pressure, and discovered for the first time the turning section and mechanism of the chain reaction of battery thermal runaway.

The study enables the measurement of the internal temperature and pressure during the thermal runaway process in the battery through the optical fiber and provides an important means for battery safety assessment and warning of thermal runaway. In the future, the combination of fiber optic sensing technology and batteries will benefit new energy vehicle manufacturing and safety inspection of energy storage power plants.

More information: Wenxin Mei et al, Operando monitoring of thermal runaway in commercial lithium-ion cells via advanced lab-on-fiber technologies, *Nature Communications* (2023). DOI: 10.1038/s41467-023-40995-3

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