

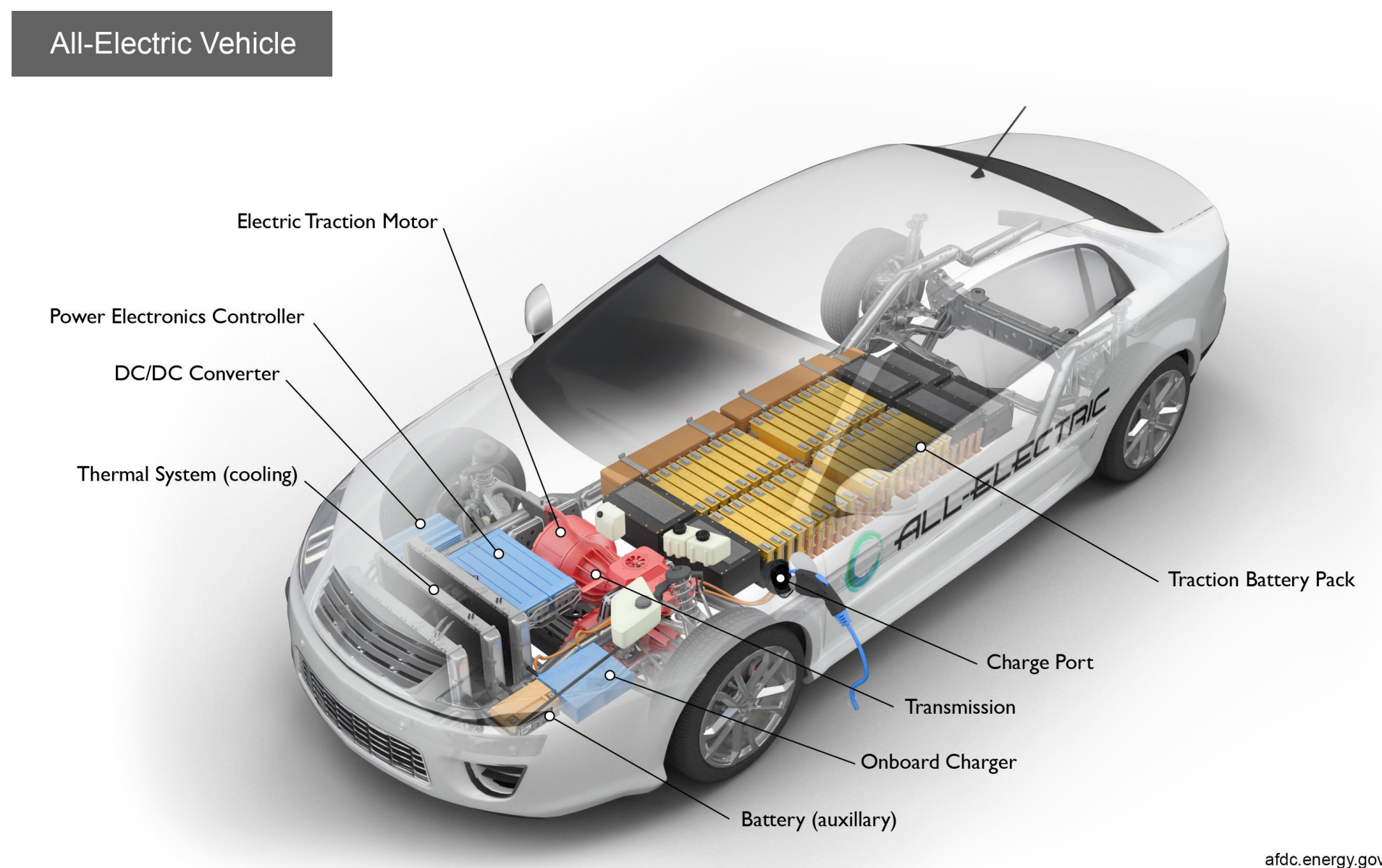
## How can electric vehicle batteries improve?

Better safety

Faster charging

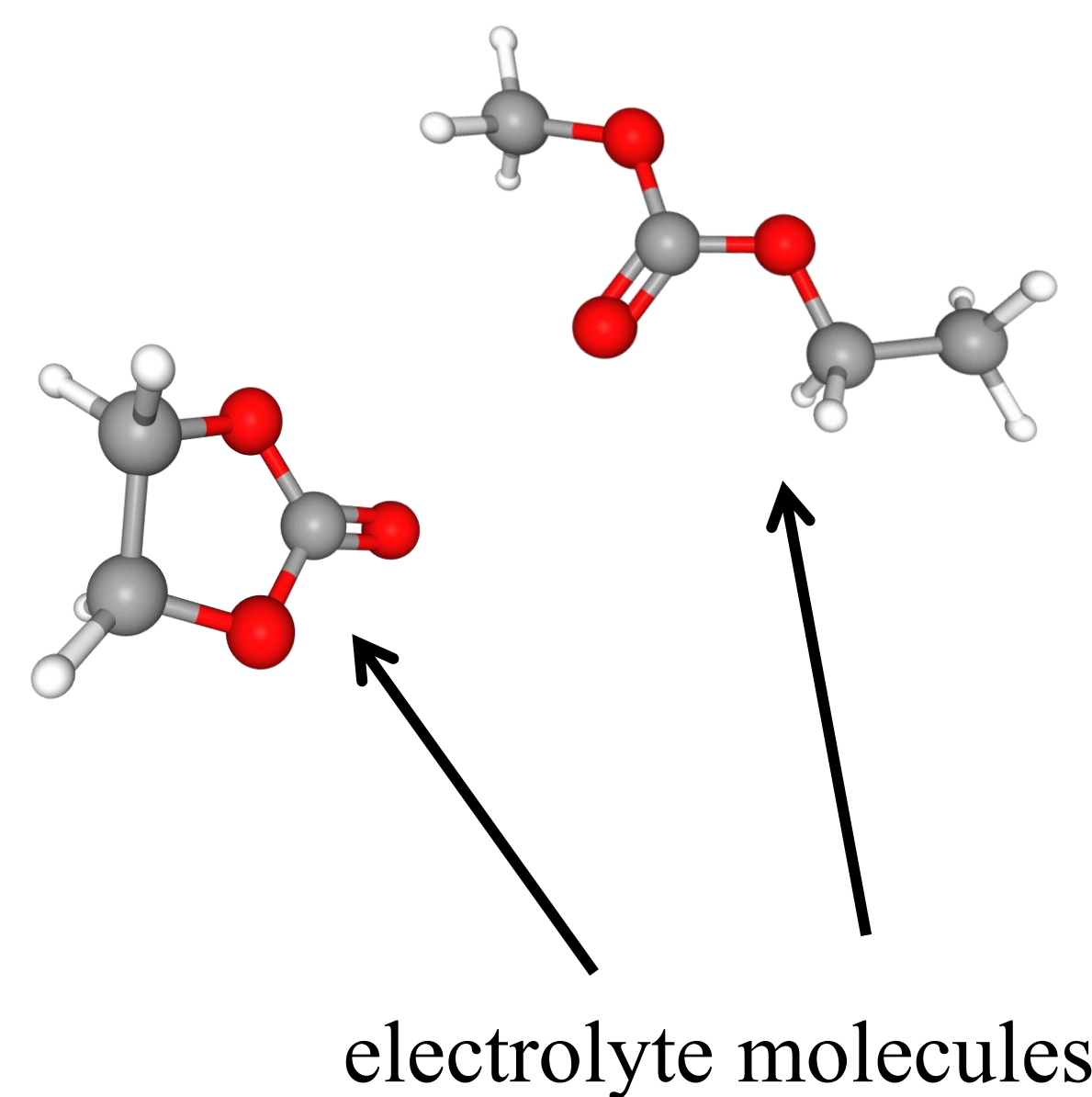
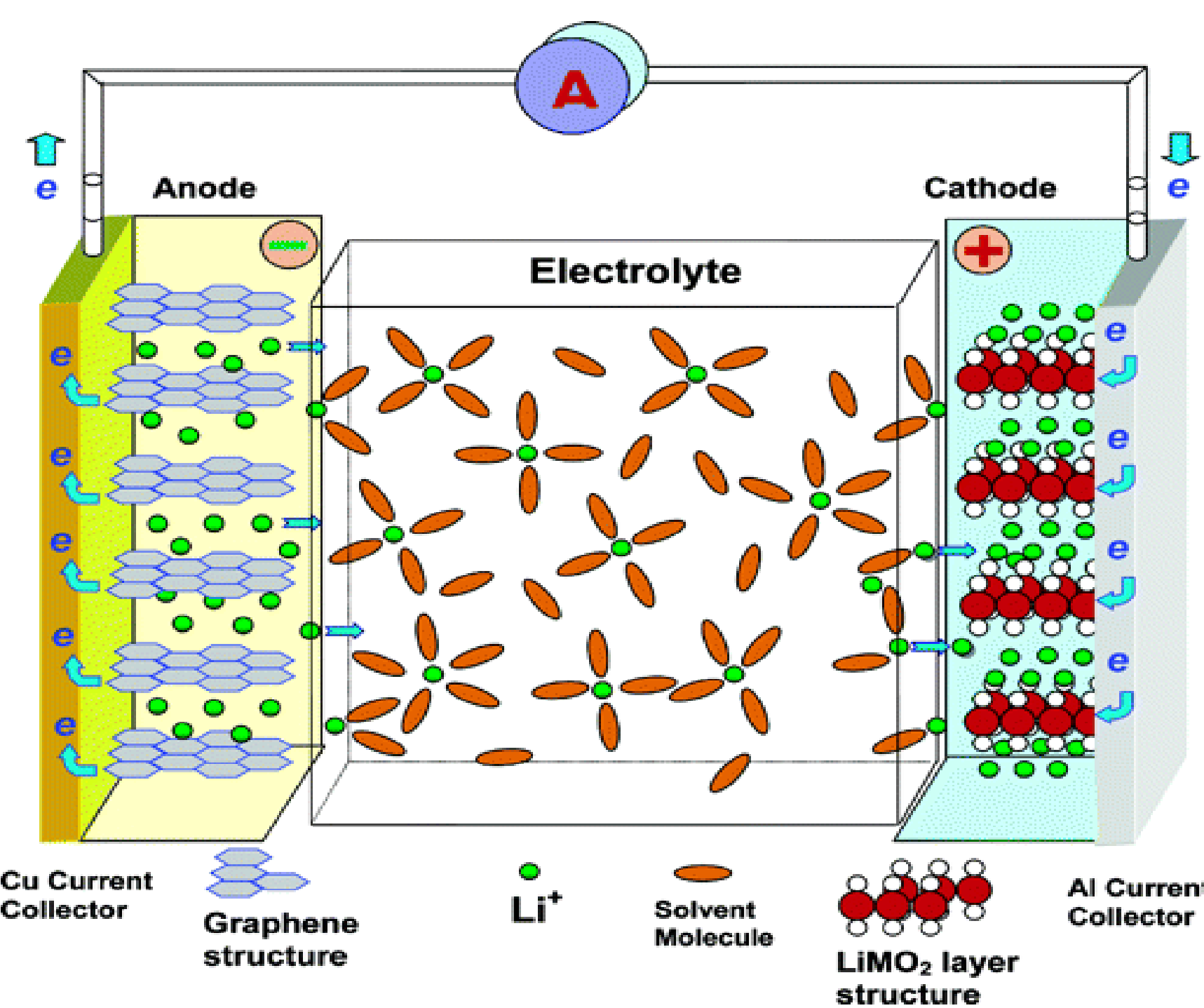
Increased range

Longer lifetime



## Batteries are made from many different materials.

Changing the materials used in Li-ion battery parts can improve charging, range, and safety.

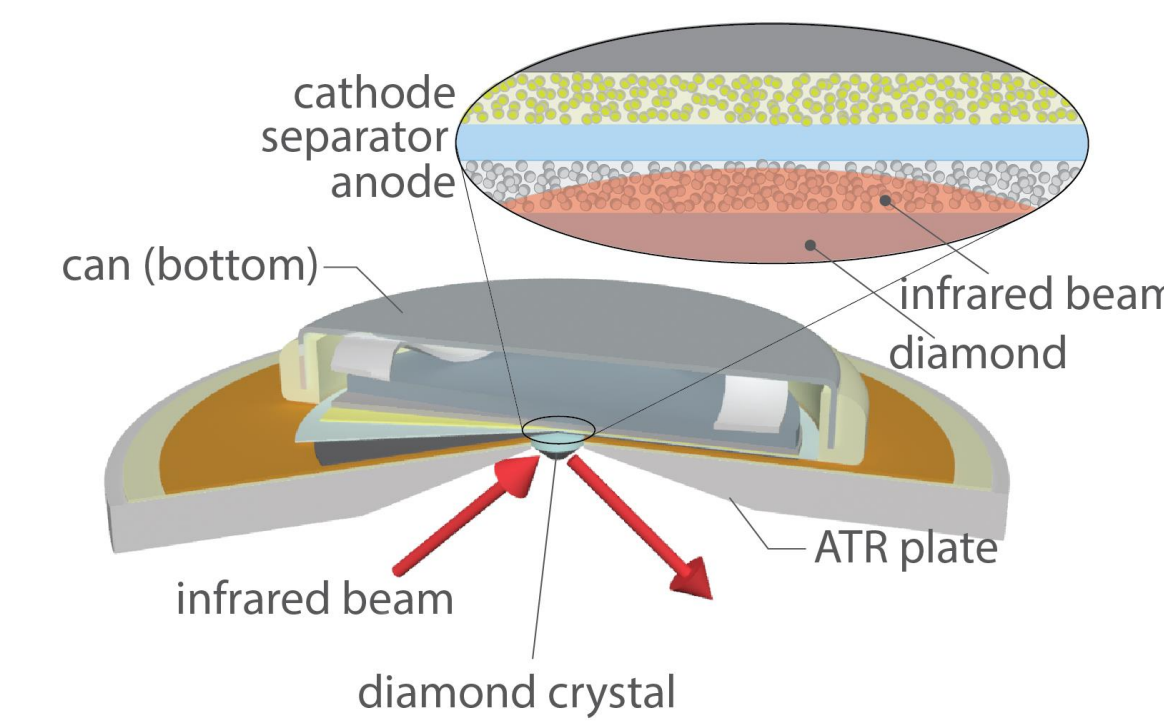


## Designing optically-accessible batteries

We have designed batteries with viewing ports for optical access. We can use infrared lasers to measure material changes inside a battery during cycling.



Instrument used to measure battery properties (infrared spectrometer)



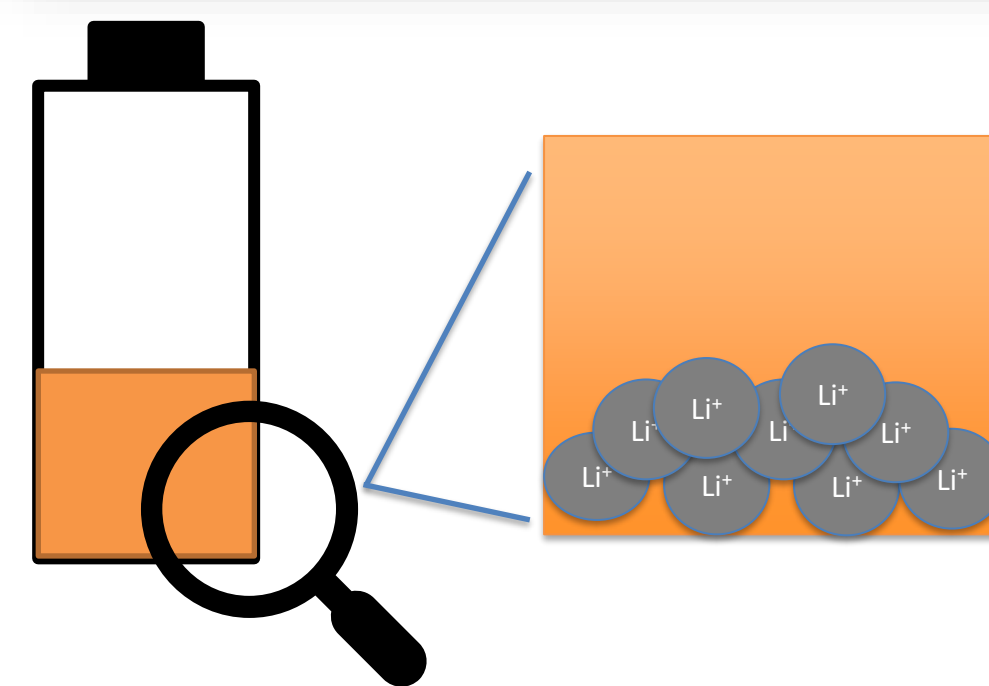
The battery is positioned atop a diamond crystal, which directs infrared light into the battery.



## How can this research help improve electric vehicle batteries?

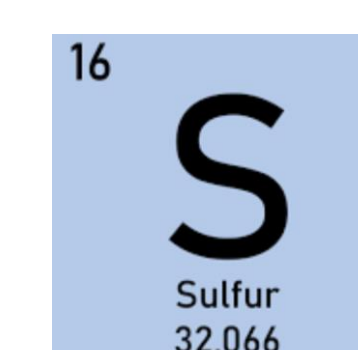
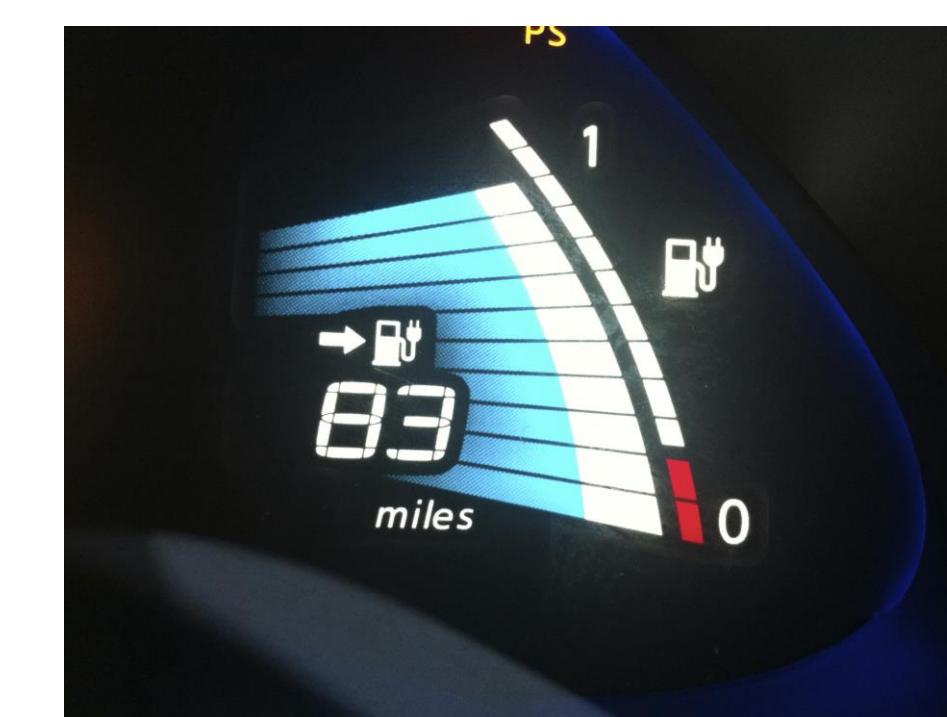
We can determine **battery properties** that can **speed up** electric vehicle charging.

We measured **lithium ions accumulating** on one side of the battery. This revealed **limitations of current electrolytes**.



We can **test batteries** made from **earth-abundant materials**, such as **sulfur**.

We measured how **changes** in the **electrolyte** of lithium-sulfur batteries can **improve vehicle range**.



We can study the **causes** of electric vehicle **battery fires**.

We observed molecules **breaking down at high temperatures**, which could lead to a **fire**.

