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# SYNTHESIZING BETTER BATTERIES

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Rechargeable batteries are a part of our daily lives. One example of a rechargeable battery is the lithium ion battery that we use to power our mobile phones, laptops and electric cars. The parts responsible for the function of a battery are the anode and the cathode. The anode and the cathode are made of functional materials commonly called the electrode materials.

The different things we use rechargeable batteries for demands different battery properties of them. For example, some applications need to be able to charge and discharge fast and others need to keep the charge for a long time. These battery properties and many others are mostly determined by the electrode materials and their structure, e.g. atomic arrangement, particle size and shape. It is therefore very important to make materials with the right structure to be able to make the best battery for each application.

Our research group wants to make batteries better by studying the synthesis, structure and battery properties of electrode materials. This we do by synthesizing new electrode materials, studying the structure and then making batteries from them to test the battery properties. Especially we want to see how the battery properties and the structure are connected and how the structure and synthesis are connected.

To learn about the relationship between the battery properties and the structure we use in operando measurements (in operando is Latin for “while working”). This measurement method looks at the structure of the electrode material while the battery is being charged and discharged. This often gives a direct connection between the structure and specific battery property. To understand the relationship between the structure and the synthesis we use in situ measurements (in situ is Latin for “in place”). This measurement method looks at the structure of the electrode material while it

is being synthesized. This gives us information about how to synthesize electrode materials with a certain structure.

Understanding the relationship between synthesis, structure and battery properties allows us to design better electrode materials and therefore better batteries. By knowing the relationship between battery properties and structure we know how the structure of the electrode material has to be to get certain battery properties. And by knowing the relationship between the structure and the synthesis we know how to get the desired structure of the electrode material. Therefore, we are able to tailor make the battery properties through the synthesis and get the best possible battery for each application.

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