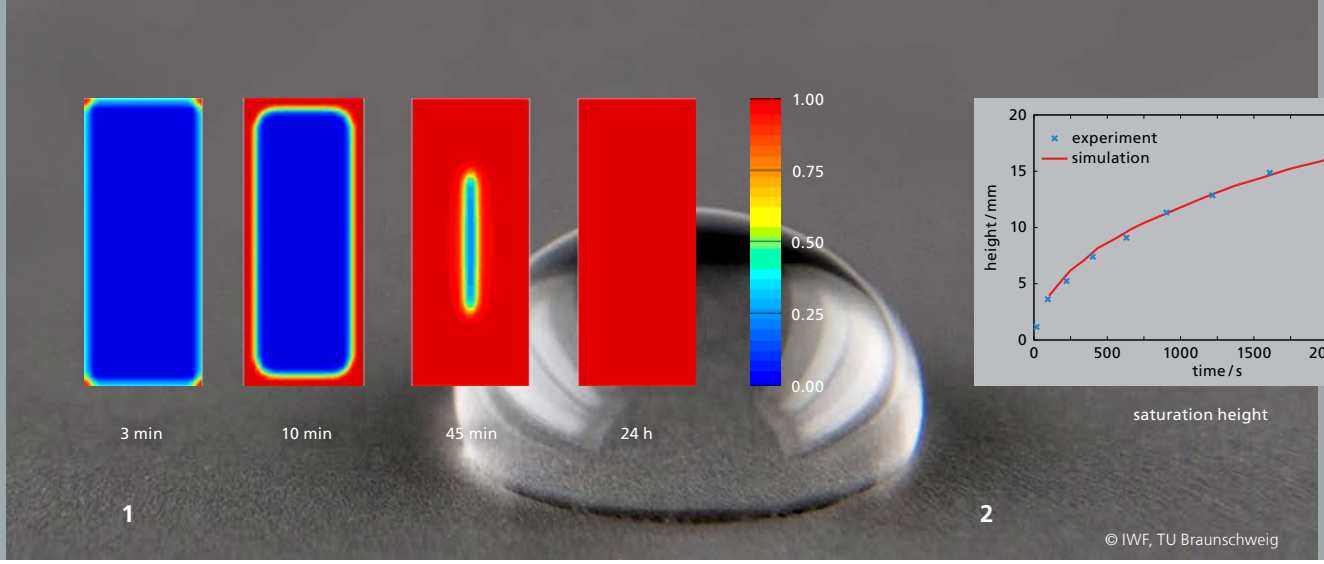

MODELING THE PRODUCTION PROCESS OF LITHIUM-ION BATTERIES

Scientists at twelve German universities and research institutes are working in the competence cluster for battery cell production (the ProZell Cluster) for the purpose of studying and improving the production process of battery cells and assessing various influences on cell properties and product development costs. Their work will provide the scientific basis for the sustainable development of a globally competitive battery cell production industry in Germany. We are involved in the project Cell-Fi which aims at improving the electrolyte filling process.

1 *Electrolyte saturation within electrode plane at different times during the wetting process*

2 *Comparison of liquid rise in porous electrode in simulation and experiment Exp. data: IWF, TU Braunschweig)*

Cell-Fi: Modeling electrolyte filling of battery cells

The topic of the project Cell-Fi is the acceleration of electrolyte uptake through optimized filling and wetting processes: After the assembly of the cells, billions of pores of the battery components – at most only a few micrometers in diameter – are filled with an electrolyte solution. The process takes several hours because the solution penetrates via the cell's small side faces into the pore volume only driven by capillary forces. Furthermore, it is difficult to assess the time required to ensure a uniform wetting.

Until now, the process of electrolyte filling has hardly been scientifically investigated. A great potential exists for companies to achieve higher throughput in production and to save costs if the relationships between process parameters and wetting speed and quality are better understood.

Calculating on micrometer scale and macroscopic scale

Our task in this project is the development of simulation methods that describe the capillary-driven flow within the different porous layers of the cell. This involves several different length scales: The pore morphology at the micro-scale, together with the physical surface characteristics of the materials involved, influences the capillary forces responsible for the wetting speed. We calculate the required input parameters from the micro-scale using the GeoDict simulation software from Math2Market.

On a macroscopic scale, the main influences affecting how the liquid distributes within the cell are the cell dimensions and the positioning of the surfaces through which the electrolyte enters the cell. Here, we use our ITWM software platform CoRheoS. Together, the GeoDict and CoRheoS tools let us predict the wetting times for various cell geometries, pore distributions, and material properties.