EMBATT BIPOLAR LITHIUM BATTERY CONCEPT – APPROACH TO INCREASE ENERGY DENSITY FOR AUTOMOTIVE APPLICATION

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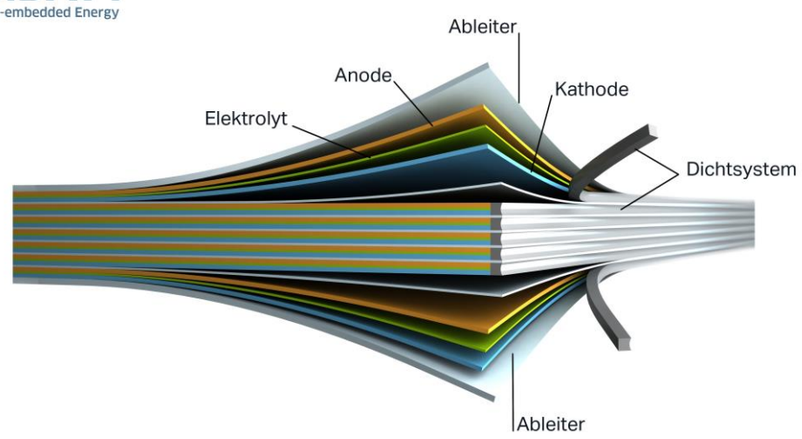
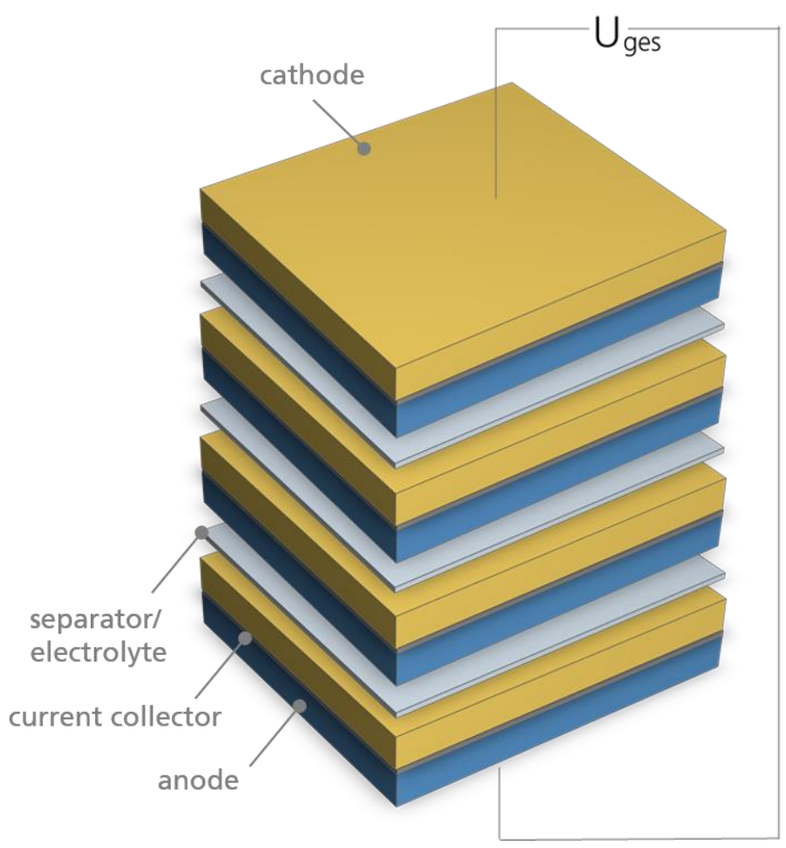
MOTIVATION

Conventional monopolar lithium batteries are strictly limited in energy density due to the high share of inactive components and limited volume utilization on cell as well as on system level. The EMBATT bipolar battery concept reduces the amount of inactive components and leads to improved integration properties for automotive applications.
On the other hand there are significant challenges in the cell concept and development of suitable technical solutions for manufacturing of the battery electrodes. Fraunhofer IKTS is addressing those topics in a collaborative project together with IAV GmbH and ThyssenKrupp System Engineering.



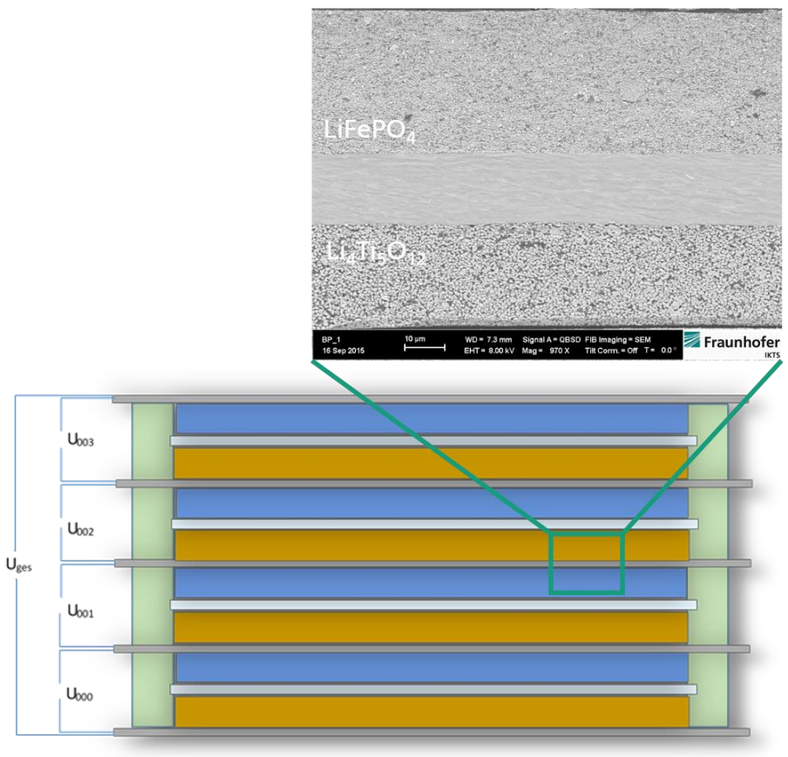
BIPOLAR BATTERY CONCEPT

General structure:
- Stack of electrodes in series
- Large electrode areas
- Integration of cell stack in one housing
- Reduced contacting effort, extremely reduced internal resistance
- Elimination of module boundaries



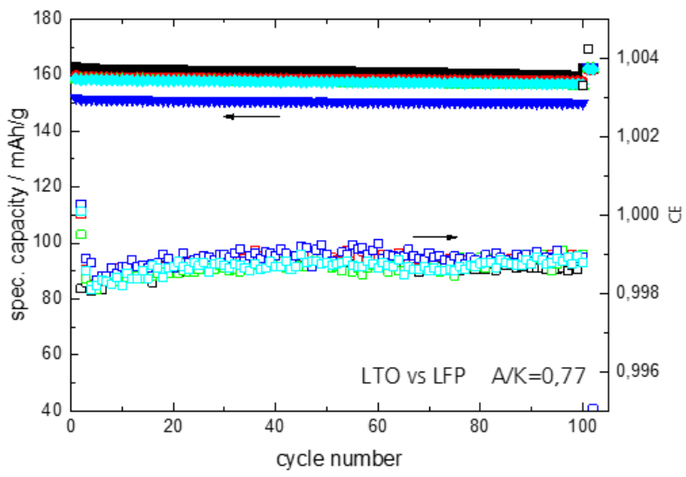
Research topics:
- Influence of bipolar cell geometry
- Development of components (sealing, …)
- Investigation of relevant failure modes

Active material system:
- $LiFePO_4$ vs. $Li_4Ti_5O_{12}$

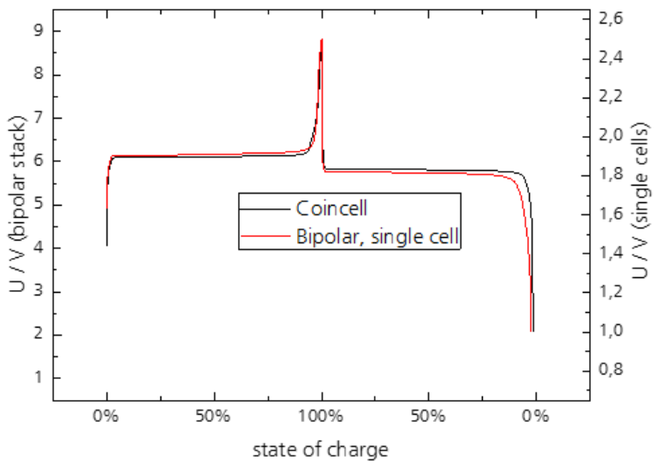


ELECTRODE, CELL AND STACK DEVELOPMENT

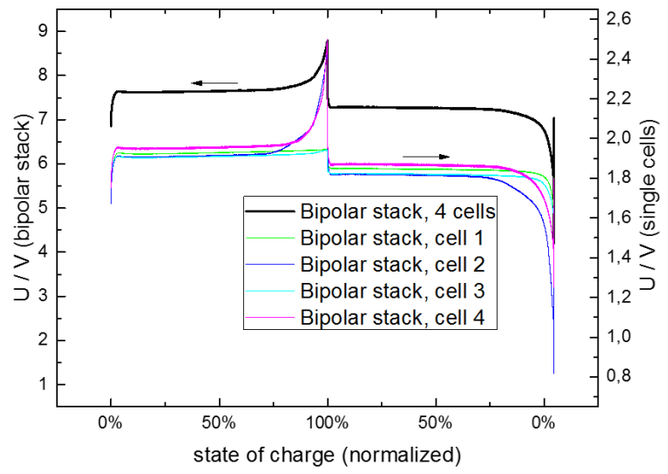
- Development of bipolar electrodes
- Cycle life test LTO vs. LFP electrode



- Design of electrodes (balancing, capacity, performance)
- Comparison of bipolar single cell vs. classical electrodes in coin cell



- Stack design
- Bipolar stack cycle and measured single cell voltages



CONCLUSION

- Increase of energy density requires optimization on material as well as on cell/system design level
- Only the combination of several improvements will meet the requirements
- Bipolar battery concept is one opportunity to reduce system complexity significantly
- Bipolar battery involve next generation materials and therefore require a new manufacturing approach

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Europäische Union

Europa fördert Sachsen.
EFRE
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