Motivation
Lithium ion batteries (LIBs) are widely used as power source in portable electrical applications. In particular with regard to optimization of existing applications or development of new technologies, it is necessary to understand the fundamentals of ionic and electronic transport inside the active cathode material. Most scientists are examining cathode materials by using composite electrodes which also contain additives influencing their electrochemical properties. To avoid such influences it is desirable to investigate the electrochemical properties of the pure active material.

Experimental setup
- As an active material for LIBs, Li(Ni0.8Co0.1Mn0.1)O2 (NCM-111) single secondary particles sintered at 900 °C[11] were investigated.
- A Hebb-Wagner like cell arrangement was realized by making use of ion blocking metal electrodes suppressing the ionic current [2].

Results
- Secondary particles have been contacted individually enabling electrochemical impedance spectroscopy (EIS) as well as polarization measurements.
  - The EIS results on single secondary particles imply a correlation between the total resistance and diameter of the secondary particle.

By using a simple model, it was possible to estimate the electronic conductivity of NCM-111 secondary particles, which had been sintered at 900 °C, to (0.52 ± 0.12) µS cm⁻¹. This estimation is in good agreement with the results of R. Amin on compact pellets [4].

Sample preparation
- A layer of a mechanically, thermally and chemically stable photoresist has been prepared and patterned on top of a metal film.
- Secondary particles have been arranged on the patterned substrate by making use of the meniscus force deposition method.

Outlook
Future tasks:
- Development of proper model for describing the observed correlation (R vs. d⁻¹)
- Load-dependent experiments
- Investigating transport properties of secondary particle ensembles
- Adopting the experimental approach to study ionic transport in secondary particles

References:
[3] SEM-Investigation performed by Markus Osenberg, Department of Materials Science and Technology, Technische Universität Berlin (markus.osenberg@tu-berlin.de).

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