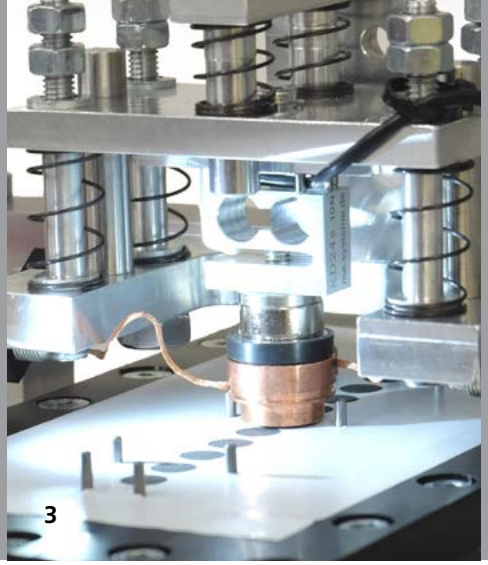

1

2


3

NEW, NON-INVASIVE RESISTANCE MEASUREMENT FOR BATTERY FOIL

The enhancement of electric energy storing is of vital societal importance, since the increasing use of regenerative energy sources and decentralized energy production (for example solar systems on rooftops) requires improved storage systems. Lithium-ion batteries (LIB) are a promising technology for this purpose. LIBs are increasingly being used in the fields of mobile applications as well as in the automotive-sector. In this context, the Application Center for Plasma and Photonics of the Fraunhofer IST is working on an improvement of said batteries. Special metal foils as carrier material for LIB electrode layers are being developed. The starting point of the related project "Batteriefolie mit Kohlenstoff-Kontaktschicht KoKon" (battery foil with a carbon contact layer) is to minimize electric resistances in electrodes. This is achieved through plasma-generated functional layers. In addition to the production of battery foils, a reliable determination of the electrical properties of the manufactured foils and battery electrodes is an important aim of the project. To accomplish this, a new measurement system is being developed within the framework of this project: e-CON.

Resistance measurement system e-CON

When it comes to measure the electric resistance of objects with a coarse surface, like LIB electrodes, it is often not possible to establish a loss-free contact. Usually, measuring tips and pins are used for this purpose. However, these cause 'parasitic' voltage drops in the contact zone as well as being invasive. Both can significantly distort the measurement result and affect the reproducibility of the measurements.

With the aim to realize non-destructive and stable low-resistance measurement contacts, a contact probe was developed at the Application Center for Plasma and Photonics of the Fraunhofer IST. Here, magnetized micro particles with an excellent conductive coating are used. Under the influence of a carrier magnet, the micro particles form oblong particle chains that are in contact with said magnet. Through this, a three dimensional form with antenna-like flexible structures emerges. When the testing tube is placed on the electrode surface, the structure reforms and adapts to the topography. Due to the high particle relocatability, form closure can be achieved without any mechanical load on the object. With the help of a suitable sensor for the height positioning of the testing tube, the contact force on the test object can be controlled and regulated with a z-axis control.In total, on the whole loss-free electron transport from the measured object into the probe structure and the measuring device (e. g. a micro ohmmeter) is ensured. This is a major requirement in order to gain reliable measurement results.

Fraunhofer Institute for Surface Engineering and Thin Films IST | Bienroder Weg 54 E | 38108 Braunschweig | Germany

4

Outlook

The present results reveal that using battery foil leads to an increased performance of lithium-ion cells. In the further course of the project, the production of foil and cells as well as battery tests in an industry-oriented technical center will be continued. The e-CON laboratory instrument is currently being transferred to a compact, semi-automatic measurement system.

The project

The R&D project 'Batteriefolie mit Kohlenstoff-Kontaktschicht KoKon' (battery foil with a carbon contact layer) is a cooperation of the Application Center for Plasma and Photonics of the Fraunhofer IST and the Fraunhofer Institute for Silicon Technology ISIT. The industrial board consists of eleven enterprises. The Application Center's project part is Funded by the German AiF Arbeitsgemeinschaft industrieller Forschungsvereinigungen 'Otto von Guericke' e. V. with €215,750 (€117,600 in 2015).

1 - 3 *Contacting and measurement probe for determining electric resistances in battery electrodes. (1) particle-based measurement probe, (2) enlargement of the particle chains, (3) laboratory measurement station.*

4 *Aluminum current collector foil with carbon contact layer.*

CONTACT

Nils Mainusch
Phone +49 551 3705-333
nils.mainusch@ist.fraunhofer.de