

Battery cells offer exciting future

C2 met with Prof Dr Werner Schreiber and Dr Tarik Vardag to talk about the co-operation between VW Varta Microbattery and KROENERT



Prof Dr Werner Schreiber and Dr Tarik Vardag

Volkswagen Varta Microbattery, which is based in Ellwangen, Germany, co-operates with Hamburg-based KROENERT in order to develop a new generation of Li-Ion battery cells. In an interview with C2, Prof Dr Werner Schreiber, director of research field, virtual technologies of Volkswagen and managing director of VW Varta Microbattery, and KROENERT's managing director Dr Tarik Vardag explain, how a customer-supplier relationship resulted in an impressive research project.

C2: Prof Schreiber, could you first explain why coating is such an important aspect of battery production?

Werner Schreiber: Coating is *de facto* the first step after the mixing of a battery component – and this requires the highest precision. Any deviations in thickness will have critical consequences for a battery, which may feature around 100 layers on top of each other. The cell becomes thicker or thinner at the end of the process. If the cell is thinner, it contains less energy. If it becomes thicker, the pressure conditions become problematic.

Another crucial point is the constant evenness of the coating. If this does not work, winding and stacking may result in pressure marks. These, on the other hand, cause the growth of dendrites – residues around the electrodes – and the cell is defective. Only smooth and homogenous surfaces offer the basis for high-performance batteries. As a rule of thumb, everything that goes wrong during coating cannot be fixed later on. This implies that coating errors cause a significant deterioration of the quality of the cell.

C2: How did the co-operation between VW VARTA Microbattery and KROENERT emerge?

W. Schreiber: In 2007, Volkswagen started to look for a competent partner in battery technology. This is how we came into contact with Varta Microbattery, one of the first German producers of Li-Ion battery cells, as they were used for the first generation of Apple's iPod. In 2009, VW founded a joint venture together with Varta Microbattery. Its aim was to conduct research in the field of battery cells and their manufacture. In this context, we were

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These coin cells are already serial produced by VW VARTA Microbattery

looking for a coating line supplier with high technological development competence.

During a visit to Prof Dr Kwade of TU Braunschweig, we noticed a KROENERT laboratory line, which pretty much fulfilled our requirements. This is how we started our mutual dialogue and subsequently determined the specifications of the desired machine. Shortly afterwards, we have given the order pretty quickly to KROENERT. After commissioning, we continued to work together in order to optimise the coating routines. Consequently, an efficient and trusted relationship has been forged..

Tarik Vardag: For us, the request from VW VARTA Microbattery was an exciting challenge. At that time, we had just delivered our first laboratory coating lines and already collected some experiences in anode, cathode and separator foil coatings for batteries. In this sense, we were up for the task. During the project, we could learn a lot of new things and find ways to realise the necessary specifications.

C2: How crucial was it that KROENERT boast its own technology centre?

W. Schreiber: This was a very important factor for us. We need a partner with an understanding of, not only machinery, but also processes. In this manner, we have started a kind of 'ping pong match' between the Hamburg-based KROENERT Technology Centre and our line in Ellwangen, where we continuously conducted coating trials.

C2: Can you provide us with some facts and figures about your line?

W. Schreiber: Our machine has a maximum coating width of 470mm and a 10m long dryer. The coating speed ranges at 5m/min – one sided, since this guarantees a better application quality. In the meantime, we are more precise with the results on our line than a Swiss clock: Our original aim of attaining a thickness tolerance of +/- 1µm has been over-achieved significantly by now. The line features five drying zones, which can be controlled separately and are heated by means of thermal oil heating cycles. The whole machinery is located inside a cleanroom – the room climate is controlled and the air is filtered.

C2: Is the line already in use for a concrete production?

W. Schreiber: At the moment, the machine is used for different reasons, primarily as a laboratory line – for working on new recipes, which are supposed to be tested to a smaller extent. If their performance has been proven, we use larger volumes for coatings and produce our electrodes for battery cells, which can then be built into the prototypes at Volkswagen.

Moreover, we produce electrodes for batteries, which are used in storage applications. With one product, we are already in serial production. The electrodes are used successfully for the CoinPower cells from VARTA Microbattery.

The small cells are Li-Ion accumulators as we find them, for example, in headsets. This wouldn't have been possible if we hadn't been able to rely on a very good coating technology at the beginning of the production chain. So, we are not really a mere research company anymore, but rather a producer of electrodes for lithium microbatteries.

C2: The step from lab to fab is therefore completed – how do you move on? What are your goals in the middle or long term?

W. Schreiber: At the moment, we are not yet economically competitive with the width of the manufactured electrodes compared to Asian producers. This poses the task of developing new high performance cell chemistries and manufacturing methods, which enable a real, competitive mass serial production in Germany.

T. Vardag: We are glad about the fact that KROENERT is able to support this process. We may not be responsible for the cell chemistry, but we try to make our contribution for more efficiency by adjusting and optimising our lines. At the moment, we are working on, for example, bigger widths and simultaneous double-sided coatings – two aspects promising a significantly higher economic competitiveness.

C2: Are these efforts to make Germany in important future markets more competitive supported by the government?

W. Schreiber: Yes, indeed. In this context, I would like to mention how proud I am that, together with KROENERT, we are part of a research project that is funded by the Federal Ministry for Economy and Energy. There we are working on new technologies for cell chemistries with a higher performance and energy density.

C2: Are further companies part of this project?

W. Schreiber: Yes, we are flanked by leading materials suppliers such as Wacker, Clariant and BASF.

T. Vardag: This co-operation of machinery constructors, chemistry suppliers and producers offers big opportunities. In this combination, we can take huge leaps forward.

C2: Could the development of even safer batteries be an advantage against Asian providers?

W. Schreiber: This is precisely one of the aims of our research. The currently prescribed safety levels are not sufficient for us – and in particular also not for our purchasers, Volkswagen and VARTA. We want to become even safer. With KROENERT, we are currently trying to equip cells with new special coatings so that the battery cells become even safer. However, this will require a lot of testing still.

C2: This sounds like an interesting future.

T. Vardag: Yes – we still have lots of exciting things in mind together... ■