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Contact

Julia Conrad
Marketing Communications
Coperion GmbH
Theodorstraße 10
70469 Stuttgart/Germany

Telephone +49 (0)711 897 22 27
Fax +49 (0)711 897 39 74
Julia.conrad@coperion.com
www.coperion.com

Press Release

Fuel Cells - On Their Way to the Everyday:

Coperion Partners in Development of Manufacturing Technologies for Graphite-Polymer Based Bipolar Plates

Stuttgart, October 2021 – Within the framework of a joint project with the University of Stuttgart's Institute for Plastics Technology (IKT), Robert Bosch, and Matthews International / Saueressig, Coperion is working on the continued development of proton exchange membrane (PEM) fuel cells for efficient delivery of energy for everyday mobile use. Bipolar plates as a core element of fuel cell stacks, and in particular their thermoplastic graphite compound-based implementations, are the focus of this work. The extremely high fill levels pose challenges upon the process technology, the likes of which have not been seen before. As a partner in this project, Coperion is leveraging its comprehensive expertise in developing the required machine-side solutions for manufacturing compounds.

Bipolar plates, made from graphite-polymer compounds, lend themselves to mobile applications due to their low weight. They combine properties such as electrical and thermal conductivity and gas non-permeability with markedly higher mechanical capacity than pure graphite plates can achieve. Moreover, they withstand the effects of moisture and acid media at typical operating temperatures over longer periods of time than do metal alloys.

Coperion has set this task for itself: To transfer all the experience gained in its years of feed limited plastics compound manufacturing to the preparation of mixtures consisting of high amounts of graphite and low amounts of polymer, to lay the foundation for future upscaling.

October 2021

Said Markus Fiedler, Process Technology, Team Leader of Chemical Applications at Coperion: “Our primary focus lies on two critical factors: The high proportions of graphite — in this project, filling levels far over 85% by weight are targeted — at concurrently low bulk density requires special equipment to feed the mixtures into the extruder and increase the possible mass throughput. We want to optimally integrate this difficult material input into the process. Parallel to this, we are also optimizing the incorporation of fillers into the polymer, to avoid creating agglomerates and degrading the polymer during compounding.”

FET Technology and Process Optimization

For the base technology to improve intake behavior, Coperion uses patented Feed Enhancement Technology (FET), which is ideally suited when finer, non-compacted fillers are used. The intake section of the side feeder is equipped with a porous, gas-permeable wall. A vacuum is fitted on the outside, and part of the air contained in the mixture is sucked out. The bulk density thus increases and with it the material's absorption capacity in the side feeder.

Coperion has also developed a process-optimized machine concept to homogenize the mixture. Parallel to this, the company is using numeric 3D flow simulations (CFD) for virtual and real optimization of the polymer and filler mixing process. Along with the project, Coperion is also developing an inline quality tool to detect process and product fluctuations, whereby the regulation of compound quality should be realized in real time.

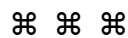
Continued Fiedler, “All the involved partners bring many years of experience, comprehensive knowledge and highly skilled colleagues in their respective fields to the table. Trusting close collaboration and coordination create prime conditions for a successful completion of the project. And best of all - at the end - the journey to fuel cells in mobility can be shortened.

The project is being promoted under registration number 03ETB028B of the German Federal Ministry for Economic Affairs and Energy using the acronym GrabaT (Graphite-based Bipolar plate Technologies).

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About Coperion

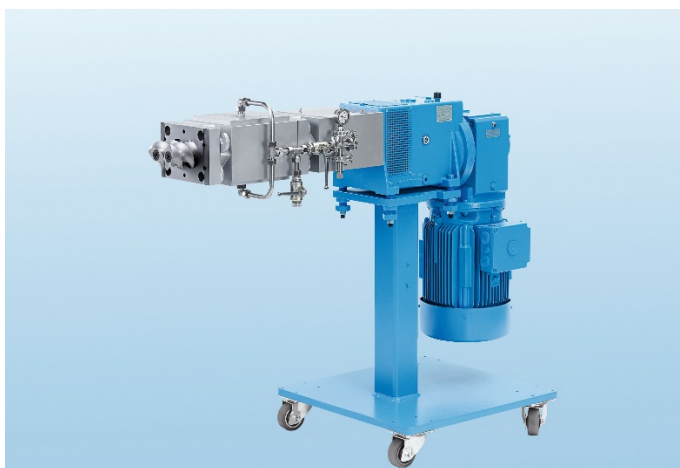
Coperion is the international market and technology leader in compounding and extrusion systems, feeding and weighing technology, bulk materials handling systems and services. Coperion designs, develops, manufactures and maintains systems, machines and components for the plastics, chemicals, pharmaceutical, food and minerals industries. Within its two divisions – Polymer and Strategic Markets / Aftermarket Sales and Service – Coperion has 2,500 employees and nearly 30 sales and service companies worldwide. Coperion K-Tron is a brand of Coperion. For more information visit www.coperion.com or email info@coperion.com.



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Editorial contact and copies:

Dr. Jörg Wolters, KONSENS Public Relations GmbH & Co. KG,
Im Kühlen Grund 10, D-64823 Groß-Umstadt
Tel.: +49 (0)60 78/93 63-0, Fax: +49 (0)60 78/93 63-20
E-Mail: mail@konsens.de, Internet: www.konsens.de



With the aid of patented Feed Enhancement Technology (FET) from Coperion, intake of difficult material within the process can be optimized.

Photo: Coperion, Stuttgart Germany

October 2021



In this project, addition of fillers to the polymer in the Coperion ZSK twin screw extruder is being improved to avoid creating agglomerates and degrading the polymer during compounding.

Photo: Coperion, Stuttgart Germany