

**Electrics/Electronics.** The second meeting concerned with “plastics in electrics and electronics applications” was themed “Fuse-box Meets Dryer”, again. Applications may differ significantly – yet demands on plastics are often the same, whether in household appliances or in automobile electrics.

## Withstanding the Heat

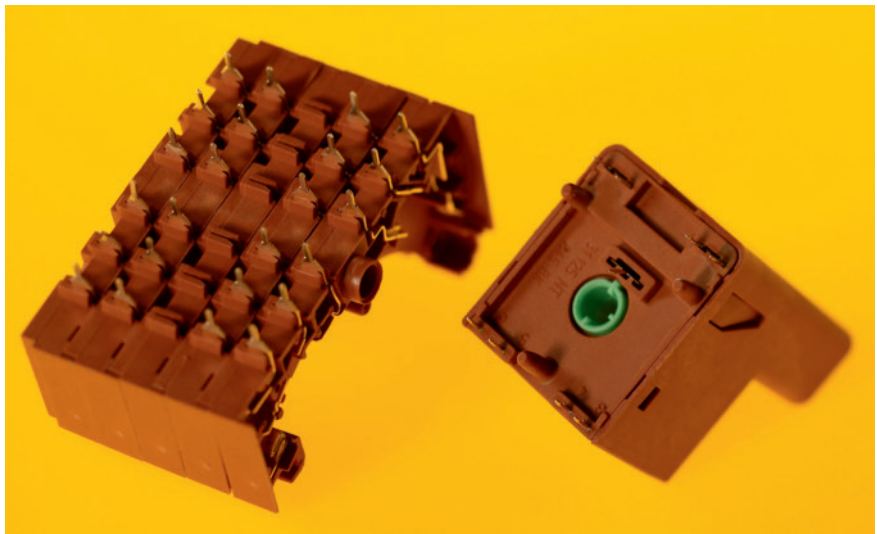
**M**ore than 100 people came to Marienberg Fortress in Würzburg, Germany, on June 5 and 6, to take part in the second meeting on plastics in electrics and electronics applications. While dealing with a wide range of topics, the meeting once again resumed the discussions along the value chain – starting from plastics and additives, via machines and components, up to the finished product. Together with Süddeutsches Kunststoff-Zentrum (SKZ), the companies A. Schulmann, BASF, Lanxess, Clariant and KraussMaffei had organized this meeting.

### Seeking the Ideal Material

Franz Josef Bergmann, Weidmüller Interface GmbH & Co. KG in Detmold, presented an outline of the ideal material for plastics parts in general electrical engineering. When used as “insulators”, thermoplastic materials must meet a vast range of requirements. They have to comply with international safety standards: flame retardance, insulation properties as well as resistance to creep, temperatures and flames are some of the technical requirements. In addition, the materials are to guarantee easy processing, which calls for good flowability and short processing cycles, too.

Weidmüller Interface products are listed at UL (Underwriters Laboratories, USA). Changing the series is therefore only possible at high expenditure and with a new listing. As a result, materials are mostly used over the entire life of a product, without any alteration. PA 66 is most commonly used, in V-0 and V-2 fire protection classification types according to UL 94. In many respects, polyamides fulfill the demands classified; still there are some weak points that should be improved:

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**Control modules, such as these by the company Diehl-Ako, are made of halogen-free, flame-retarded Ultramid, i.e. the polyamide by BASF. Components must comply with the IEC 60335-1 standard for unattended household appliances** (photo: BASF)

Temperature resistance should be above the RTI (Relative Temperature Index) value of 130°C. At the same time, materials are to absorb less moisture, in order to improve dimensional stability. In large connectors, tolerances are very narrow for distances between contacts, and this is why they cannot deal with length variations due to temperature fluctuations.

### Connectors for Cars and Household Appliances

RTI as part of UL listing was one of the major subjects, too, in the lecture held by Dirk Pfaffenbach of Lumberg-Connect GmbH in Schalksmühle, Germany. He used connectors that are employed for cars as well as household appliances, to show which stages are important in material selection. Automotive manufacturers' criteria and standards differ significantly from those put up by producers of electrical appliances. For an enterprise like Lumberg to produce and supply efficiently, it is therefore necessary to devel-

op products that likewise fulfill both groups' requirements.

A household appliance will be approved globally, if each single component complies with all criteria of approval. For connectors it is thus indispensable to be UL-listed. Each listing is related to one single temperature of permanent use. While applying a certain intensity of current to a connector, the operator can measure the heat that develops there. This heat adds up to the temperature of the environment. Derating curves provide information as to the permanent environmental temperatures a connector may be used at. These curves take into account the intensity of current in the connector, the RTI of the material employed, as well as a safety factor. Accordingly, if the connector is to be approved for permanent environmental temperatures of 80 to 90°C, the material's RTI must be 130°C.

The possible fire hazards in a vehicle were described by Wolfgang Lang from Elz, Germany, an independent surveyor ▶

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for fire damage. He stated that, of all fires in vehicles he has learned about, 40 % were caused by vehicle electrics.

### Materials for the Future

Dr.-Ing. Robert Greiner of Siemens AG in Erlangen, Germany, introduced innovative materials for the future. Descriptively he explained the possible fields of applications for electrically conductive compounds for injection molded conductor tracks with integrated cable contacting which may replace traditional lead frames. Possible applications also comprise 3-D MID and mechatronics, injection molded contact pins, but also thermal fuses and resistance heating. As a second innovation, heat-conductive compounds were presented – which are able to improve the performances of sensors and actuators, and might even be used in micro electronics and casings.

### Leak-resistant Compounds

Dipl.-Ing. Marius Fedler, Kunststoff Institut Lüdenschaid, Germany, explained the problems involved in leak-resistant compounds while overmolding inserts. Lead frames embedded in a polymer material are a standard component of electrical engineering today. Leak resistance is a prerequisite for these compounds to guarantee for constant electrical properties, even in a humid environment. Fedler described some techniques to monitor densities and presented a demonstrator employed for such type of examinations with a specific kind of specimen geome-

**The polymeric Pocan DP 2004 by Lanxess is the first polybutylene terephthalate (PBT) to be approved by the VCE Testing and Certificate Institute, for use according to the IEC/EN 60335-12 standard ruling household appliances. This material is applied, e.g. for thermal insulation rings to fix and insulate the hot plates of coffee machines** (photo: Lanxess)



try. This facility was developed at the Lüdenschaid institute.

### Functions Integrated in Complex Components

Joachim Czabanski of Kromberg & Schubert in Renningen, Germany, showed an impressive example of integrated functions in complex plastics components. He presented a three-dimensional component that was partially metallized by laser activation. The conductor tracks obtained permit for 14 switches to be integrated within a space that used to provide room for only seven switches before. Additionally, the usual FR4 circuit board could be dispensed with. The board presented permits for up to 256 variants. Kromberg & Schubert employ a soldering technique here, which makes sure all the components are joined safely at temperatures be-

low 250°C, during vapor phase, and without melting the employed PA 66 plastic.

### Production of LEDs

Manufacturers of LEDs (light emitting diodes) in contrast, are struggling to handle the problem of components usually being soldered by a standardized technique (reflow), which applies approx. 260°C for at least 10 seconds. Dr. Gertrud Kräuter of Osram Opto Semiconductors in Regensburg, Germany, spoke about LEDs and their production. The applied soldering technique makes most standard thermoplastics unsuited for these applications. PA 66 and PET melt between 250 and 260°C. In order to suit application for LED carriers, materials should be white, so as to absorb as little light as possible. However, high-temperature thermoplastics are colored, which is a disturbing factor. LCP (Liquid Crystal Polymer) is innately yellow, making it unsuited for the purpose. At present, partly aromatic polyamides appear to be the only materials to stand a chance.



**Casing for an induction stove top by the company EGO: High-performance electronics in household appliances with conducting components made of polyamide compounds, such as Schulamid 66 MW30 FR4 by A. Schulmann GmbH, are densely packed inside this casing, complying with UL 94 V-0 and GWIT 775 without flame** (photo: A. Schulmann)

### Keep on Seeking the Materials

This extraordinarily interesting lecture and the discussions following several presentations made one thing clear: Changes in the market, i.e. UL admission criteria, reflow soldering, new GWT standards, in connection with demands for V-0 and high RTI constantly make it more difficult to find an adequate material. Among visitors, the opinion was heard that, for certain applications, there is not even a single material available at the market, which fulfills the entire range of requirements. This means a vast challenge for producers and suppliers.

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