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It weighed over a ton and was big enough to fill an entire living room: The Z3 by Konrad Zuse – the world's first program-controlled computer – had a memory capacity of only 64 words but was able to multiply and divide as well as extract the square root of a value within three seconds. For comparison: A commercially available smartphone nowadays has more processing power than the Apollo Guidance Computer (AGC) – the on-board computer to navigate the Apollo space probe to the moon in 1969.

The trend is obvious: Whether in the automotive industry, in communication and power electronics or in the area of eMobility – new appliances and products become progressively smaller. At the same time, more and more functions should be packed into minimal space. But how can electronic components, assemblies and systems be downsized without them overheating and consequently loose performance or even cause malfunctions?

Thermally conductive materials are essential for minimizing built-up heat within electronic components or to effectively dissipate heat. They usually are highly abrasive potting materials with a concentration of special fillers which guarantee a reliable heat transfer between two parts – between a PCB and a heatsink, for instance. This way, the potting materials support the prevention of performance loss and malfunctions of electronic parts caused by overheating. Those materials are commonly referred to as Gap Fillers or thermal interface materials (TIM). Usually they are one or two component potting media, based on silicone, epoxy or polyurethane. Through the addition of additives or fillers, the properties of the thermally conductive pastes can be precisely modified and adjusted to the respective application.

Customized systems technology is the key
The thermal conductivity of these pastes is established with fillers like aluminium oxide, graphite, silver or boron nitride. These fillers often exhibit very high degrees of hardness, as well as sharp edges. When choosing systems for preparing and dispensing thermal pastes, it is imperative to look for manufacturing equipment which is specifically tailored to the application. Otherwise, operators are at risk of facing high maintenance and repair costs.

The use of single component materials is quite common, since they do not require mixing and thus are supposedly easier to process. In comparison to 2C systems, however, more elaborate logistics are required in this case. Depending on whether cross-linking reactions are initiated through humidity, UV rays or temperature, certain precautions have to be taken so that the curing process of the material does not start prematurely. This may involve continuous cooling of the medium or special storage conditions for pails and cartridges. 2C thermal interface materials, on the other hand, often feature preferable material properties. Additional benefits for operators are shorter curing times and reduced VOC emissions.

Thermal pastes vs. pads and foils
In contrast to solid, die-cut pads or foils for dissipating heat, thermally conductive pastes offer the possibility to realize individual contours on the component and thus enable more design freedom. Due to their conformability, thermally conductive pastes are best suited for components with complex topography or surface texture. Additionally, the fluidity of the material when compressed after its application allows for an improved compensation of possible tolerances. Especially sensitive electrical parts are exposed to less mechanical stress during assembly, which considerably reduces the risk of rejects. When using pastes, operators benefit from an increased performance, since pastes possess a higher thermal conductivity than pads or foils. Further advantages are lower storage costs, reduced or even non-existent expenditures for handling and assembly as well as the good automation capacity of the material application.

For a process reliable application with a reproducible outcome quality, it is crucial that the material is able to be dispensed by machine. If the thermal interface material is too viscous because of an extremely elevated filler ratio, it is barely processible anymore. Manual application may cause fluctuating material quantities as well as insufficient application accuracy. This could lead to inadequate or not reproducible outcome qualities. In the case of highly filled media, there is also the problem of phase separation or filler sedimentation. Here, the deployment of a proper material preparation system is imperative in order to prevent poor potting results and, by extension, rejects.

New complete solution for thermal management tasks
When applying thermal pastes, the motto is: As thin as possible and as thick as necessary. While a thin layer impedes complete contacting, a thick layer reduces heat dissipation. In order to meet the market’s demands for a process reliable entry-level solution for the application of highly viscous thermally conductive pastes, Scheugenpflug developed the new DispensingCell. It is a fully pre-configured and parametrized dispensing and potting cell which is adjusted to approved 1C and 2C thermal interface materials by well-established manufacturers before delivery. Based on the Scheugenpflug modular system, the DispensingCell is built from standardized modules. Apart from high quality components, operators especially benefit from the system’s fast availability. Thanks to Plug and Produce, a fast production launch is guaranteed as well.

The DispensingCell is available in three sizes. The single system components can be precisely adjusted to the necessary performance, the required dispensing range and the respective, tested potting material. Kanban and lean production are the basis for short delivery times and an attractive price-performance ratio.

The optimized piston dispenser Dos P016 TCA offers high dispensing speeds. With this system, thermally conductive potting materials can be applied up to three times faster – and that at a consistently high dispensing accuracy. This is proven by several test series with a thermally conductive, silicone-based 2C gap filler. Depending on the version, the Dos P016 TCA was able to reach dispensing speeds of 2.0 ml/s with an accuracy of ± 0.03 g (quantity per shot: 2.3 to 40.8 g) or 0.5 ml/s with an accuracy of ± 0.015 g (quantity per shot: 0.32 to 5.7 g).

Conclusion
Because of the increasing miniaturization of electric components for mobile devices or automotive applications, the implementation of an effective thermal management is gaining importance. Thermally conductive pastes not only offer a high performance and design freedom; they can also be adapted to the respective task. Due to their high viscosity and the substantial amount of abrasive fillers, dispensing these materials often poses a challenge. But with the proper system technology, economical processes as well as excellent, repeatable dispensing results can be realized.

About Scheugenpflug
Scheugenpflug is a leading provider of precision-engineered adhesive bonding, dispensing and potting solutions worldwide with exceptional automation expertise. Their product and technology portfolio ranges from powerful material preparation and feeding systems to advanced systems for atmospheric and vacuum potting, to modular inline and automated solutions tailored specifically to customer needs. Scheugenpflug dispensing systems are used in the electronics and automotive industries as well as in the telecommunication, medical and chemical industries.

About EP-TeQ
EP-TeQ A/S has a unique combination of know-how, tools and machines for all electronics processes - Design, Production and Quality Assurance, enabling us to assist you throughout your investment process: Before - by working with you on the requirement specification and configuration. During - by helping you select the required tools/machines and training. After - by providing you with service and support in order to ensure optimum quality and reliability of your production.

EP-TeQ A/S is distributor of Scheugenpflug products in the Nordic and Baltic Area. For further information, please contact Arne Fast Hansen on +4520983734. See also www.ep-teq.com under Scheugenpflug.