

# Pilot production of polymer-ceramic injection-moldable granules in stable quality

Dipl.-Chem. Ralph Schubert, Dr. Olaf Kieseewetter  
(UST Umweltsensortechnik GmbH)

Polymer-ceramic materials are used when plastic forming for complicated shapes is required for which standard technical plastics do not provide sufficient thermal stability. The polymer-ceramic composites developed at Fraunhofer IKTS consist of ceramic fillers and organosilicon polymers, with the option of converting the polymers into ceramic-like structures through thermal treatment. Polyceramics can be processed using various plastic forming methods (e.g. injection molding). These composites are characterized by high thermal stability (operating temperatures of more than 600 °C), low shrinkage, and high dimensional stability. Relevant material properties (e.g. electrical conductivity, thermal conductivity, dielectric properties) and processing parameters can be adapted to the specific application by selecting suitable functional fillers and binder systems.

One important area of application is the hermetic and corrosion-resistant housing of temperature sensors for monitoring and controlling machines and drive systems (application range 200 to 800 °C). Housings with complex shapes are formed by injection molding of polymer-ceramic granules (Fig. 1), additionally assuming structural and mechanical functions (Fig. 2). Corresponding applications, e.g. for the automotive industry, were developed primarily with the industrial partner UST Umweltsensortechnik GmbH in Geschwenda, who also implemented them on an industrial scale.

Local manufacturing at the industrial partners' sites requires industrial-scale processes for the production of polymer-ceramic injection molding granules. Such processes were developed at Fraunhofer IKTS based on shear roll compaction with a production output of up to 60 kg/h. For industrial use, it is also necessary to have a quality management system tailored to the manufacturing process. An example for this is the batch-related determination of flow behavior using a measured kneading process to determine the torque at processing temperature (Fig. 3). Additionally, the bending and tensile strength of injection-molded test specimens is determined and made available to the user in the form of a factory certificate.

Within the framework of pilot production agreements, Fraunhofer IKTS has supplied industrial partners with polymer-ceramic injection molding granules of stable quality for over 25 years.

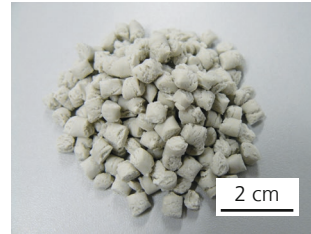


Fig. 1: Polymer-ceramic injection-molding granulate.

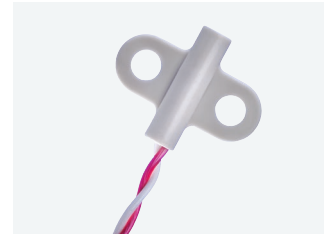


Fig. 2: Pt1000 temperature sensor up to 350 °C with polymer-ceramic housing (source: UST Umweltsensortechnik GmbH).

## Services offered

- Pilot production of injection-moldable granules
- Injection-moldable, thermally stable housing material for electronics and sensor components
- Quality management system
- Customized application development

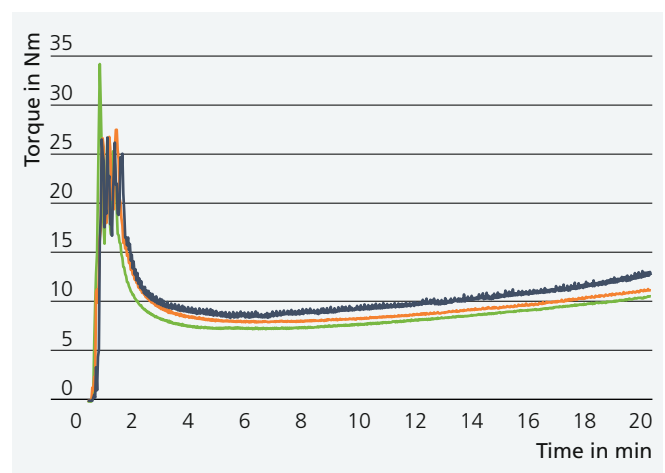


Fig. 3: Determination of torque in measured kneadings to characterize the flow behavior of different batches of polymer-ceramic injection molding granules.