



1 Potting of an electronic component.

POLYMER POTTING FOR PROTECTING ELECTRICAL SYSTEMS AND ELECTRONICS

**Fraunhofer Institute for
Manufacturing Technology
and Advanced Materials IFAM
- Adhesive Bonding Technology
and Surfaces -**

Wiener Strasse 12
28359 Bremen | Germany

Institute director
Prof. Dr. rer. nat. Bernd Mayer

Contact
Competence Platform Potting

Dr. Martin Wirts-Rütters
Phone +49 421 2246-414
martin.wirts-ruetters@ifam.fraunhofer.de

Dr. Matthias Popp
Phone +49 421 2246-650
matthias.popp@ifam.fraunhofer.de

www.ifam.fraunhofer.de

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Status quo

The growing number of electronic assemblies and its usage in, for example, cars and aircraft is placing increased requirements on their long-term stability and functional reliability. By potting or by applying protective coatings, the components become completely enclosed and protected by a polymer, so guaranteeing their efficient functioning.

The most important functions of potting compounds/protective coatings:

- Heat removal
- Mechanical protection
- Protection against penetrating media
- Electrical insulation

There are ever increasing requirements with regards to moisture resistance, temperature resistance, temperature shock, electrical insulation, and heat conduction.

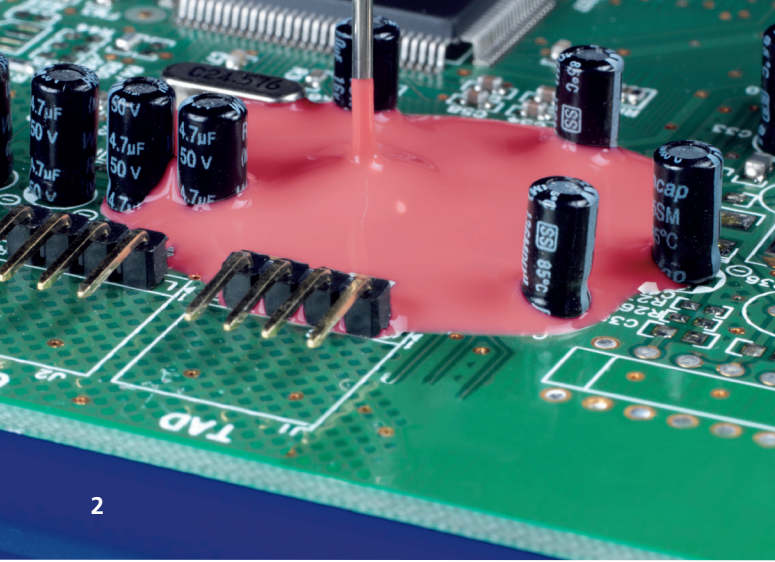
Common problems with potting

- Internal stresses in the potting compound can lead to debonding, cracks in the potting, up to the breaking off of electronic components
- Defects introduced by the process, for example cavities and incomplete curing, with subsequent penetration of moisture and functional impairment/corrosion

The coating of the assembly is usually the last step in the value-creation chain. With errors here having high cost implications or leading to unfavorable results in the field.

Fraunhofer IFAM – material selection, process development, and consultancy

The Fraunhofer IFAM is your service partner in the area of potting: the pointed approach enables you to shorten development times already within the planning and guarantee reliable product functionality.



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A holistic consideration of all material as well as production influences and their mutual interactions is necessary here. This requires the use of, amongst other things, tools for simulating the filling process (Computational Fluid Dynamics; CFD) and for predicting internal stresses (Finite Element Method; FEM) along with analytical techniques for measuring relevant material parameters.

Services

The Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM supports your company in all stages of the production process: from the selection of potting compounds, to production concepts, and right through to inline monitoring the quality of the products.

Casting compounds/

Protective coatings

Selection, development and modification of polymers to meet customer-specific requirements; characterization in the non-cured and cured state using rheological methods, thermal analysis, and IR spectroscopy, quality assurance

Design

Analysis of loads and internal stresses using FEM, determination of thermo-mechanical and mechanical parameters

Pre-treatment

Cleaning and pre-treatment methods for optimizing adhesion (plasma pre-treatment, CVD adhesion promoting layers, CO₂ snow jet cleaning, lasers, etc.)

Quality assurance

Substrate and surface characterization, including inline methods (process monitoring)

Production concepts

Plant selection, application and dosing of casting compounds

Potting process

Process optimization, troubleshooting, simulation of filling (computational fluid dynamics), consultancy on integration into the production

End properties

Testing the resistance to operating loads, media, and climatic stresses

Failure analysis

Contamination, penetration/corrosion, breaking off of components, debonding, formation of stress cracking

Pottings techniques at Fraunhofer IFAM

Manual potting

Automated potting

- under normal pressure
- under continuous or discontinuous vacuum

Protective paints and plasma coatings

Analytical equipment

- Material characterization via DSC, TGA-MS, IR, rotational rheometer, TMA, DMA, laser flash method (heat conduction)
- Mechanical tests (quasi-static, dynamic, highly dynamic, fatigue strength)
- Various special methods, e.g. for measuring reaction shrinkage, water uptake
- Vacuum potting chamber
- 1-C and 2-C dosing system-test facility
- Microdosing and micropositioning systems
- Various dispersing and synthesis techniques
- Surface analysis via XPS, AES, TOF-SIMS, electron microscopy
- Atmospheric pressure and low pressure plasma techniques, pyrosil technique, CO₂ snow jet cleaning, lasers
- Climate chamber
- Test loop for determining the stability of individual components to shear
- X-ray computer tomography for detecting inclusions, cavities, etc.

2 Partial potting of a printed circuit board.

3 Corrosion on a damaged printed circuit board.