



FRAUNHOFER INSTITUTE FOR SILICATE RESEARCH ISC

# CENTER SMART MATERIALS AND ADAPTIVE SYSTEMS



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The Fraunhofer Institute for Silicate Research ISC is one of the leading materials research institutes in Germany. It develops innovative solutions for various industry sectors such as electronics, optics, adaptive systems, generators, automotive, biomedicine, and packaging.

The institute's expertise in materials science, materials development and processing grew out of a long history of serving diverse industry needs since 1926. Fraunhofer ISC supports companies in tackling all kinds of material-related challenges deriving from their individual cases. It provides analysis of the product defects, optimizes the material-process match or develops a completely new material and process for complex patterning. Companies can be accompanied through the scale-up of production, process adaptation, pilot scale as well as high-performance analyses, if required.

Our service encompasses consulting, feasibility study and R&D projects. Not only large companies, but also numerous small and medium-sized ones are among our customers and development partners all over the world. Combined with a powerful network of outstanding research and development partners within and outside the Fraunhofer-Gesellschaft, we can also solve issues that exceed our own expertise in material and process development.

### CENTER SMART MATERIALS AND ADAPTIVE SYSTEMS (CeSMA)

When commercially available material products fail to meet any technical requirements, Fraunhofer ISC's Center Smart Materials with its unique approach can combine advantageous properties of organic and inorganic polymers and smart flexible materials together. Resulting materials have moderate processing temperatures and chemical and thermal stability with superb optical, electrical and/or switchable properties.

Features: high optical stability, low yellowing behavior, adjustable refractive index, low VOC

Processing: embossing, 2-photon-polymerisation for µ-optics, 3D printing for macro-optics

Features: for AR layers on polymer films, LED encapsulation, scratch resistance Processing: dip-coating, dispensing, low curing temperature for sol-gel materials

Features: increased life time of QD due to encapsulating matrix Processing: 3D printable, cured by UV exposure

**Electronic materials based on hybrid polymers (ORMOCER®s)** Features: high dielectric strengths, adjustable permittivity (high-k, low-k), high thermal stability, high chemical stability, improved thermal conductivity, low dielectric losses, appropriate for high frequencies, low VOC Processing: wet chemical processing (spin-coating, dispensing, spray-coating) and direct UV patterning (UV lithography, UV nanoimprint)

Features: very high stability, printable, cheap, free of scarce elements (no indium, no gallium), transparent Processing: ink-jet printing, flexo printing

Features: low resistivity, transparent (based on Ag nano wires) or black or metallic, adjustable mechanical properties, low change of conductivity under strain Processing: slot die coating, screen printing, spraving, spin coating

Features: applicable as sensors, actuators or generators; adjustable mechanical properties, chemically inert, stretchability up to 100 %, transparent Processing: doctor blade, R2R coating, slot die coating, rotary screen printing

## Features: sensitive pressure and de-forming material, integratable for large area electronics, pyroelectricity (temperature-dependency) can be suppressed or

amplified (gesture recognition), flexible Processing: R2R screen printing, S2S printing (screen printing, ink-jet printing)

Features: high temperature applications (up to 600 °C) by single crystal materials; crack or corrosion detection on hot, heavily loaded components; ultra-fast (in the ms range) temperature measurement of gases Processing: glass soldering

Features: change of viscoelasticity and shape in magnetic field, adjustable and reversible actuation, haptic feedback, appearance of control elements, changing surface contour Processing: individual sample manufacturing by molding/casting