Fraunhofer
IKTS

FRAUNHOFER INSTITUTE FOR
CERAMIC TECHNOLOGIES AND SYSTEMS IKTS

SERVICES OFFERED

Material synthesis
- Hydrothermal/solvothermal in autoclave
- Sol-gel synthesis
- Metallorganic synthesis under inert conditions
- Solid-state reactions
- Doping (with and without rare-earth)
- Up-scaling of all lab synthesis

Ceramization and activation
- Thermal treatment and sintering under inert and reactive gas atmospheres
- Calcination and pyrolysis

Dispersion and coating
- Up to 40 wt% phosphor in slip or slurry
- Dip- and spin-coating
- Inkjet printing
- CVD and PECVD

Characterization
- Powder analysis (phase, morphology, size, appearance, etc.)
- UV-Vis-IR transmission and reflection measurements
- Photoluminescence (excitation and emission)
- Thin-film thickness and optical parameters

FRAUNHOFER IKTS

The Fraunhofer Institute for Ceramic Technologies and Systems IKTS, a member of Europe's leading organization for applied research, covers the complete field of advanced ceramics, from basic research to applications.
Fraunhofer IKTS is specialized on precursor-derived powder synthesis of materials such as oxides, carbides, nitrides and the subsequent processing to bulk materials, composites as well as coatings. More than 10 years of experience in manufacturing and characterization of transparent oxide ceramics and the synthesis of optical-functionalized powders and materials prove the IKTS as competent and reliable partner for your developments.

CONTACT

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PHOSPHOR POWDERS AND OPTICAL CERAMICS

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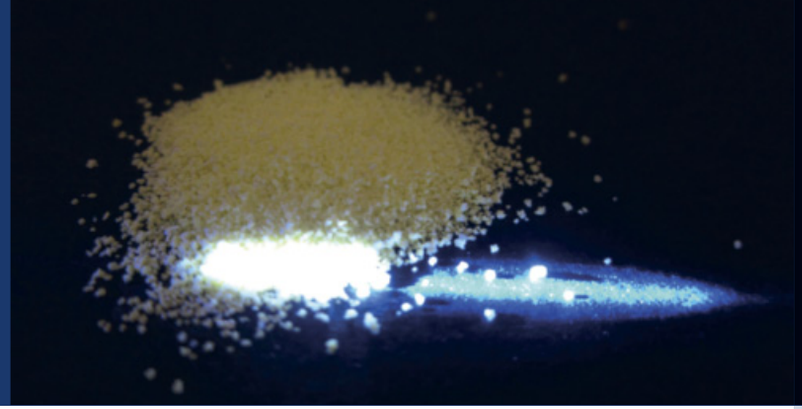

The precursor-derived ceramics group at the Fraunhofer IKTS has a strong background on various synthesis methods to provide ceramic materials from the nanometer scale up to transparent bulk materials, which offers all the advantages to tailor the required material.

PHOSPHOR POWDERS

In order to achieve materials for lighting and light emission diodes (LED) the principle of photoluminescence is used in phosphors. By the variation of the assembly of the lighting source colours similar to daylight can be realized. One way is to excite different phosphors comprising a blue, red and green phosphor by UV light which is used by energy saving bulbs. Another lighting setup is due to the interaction of a blue semiconducting diode and a yellow phosphor (white LEDs).

Afterglow phosphors are used for labeling of emergency exits while blue, green, red and yellow phosphors are used in lighting bulbs. Hexagonal $NaYF_4$ is one of the most efficient host material for green (Yb^{3+}/Er^{3+} codoping) and blue (Yb^{3+}/Tm^{3+} codoping) phosphors used in up conversion and is applied in healthcare.

While photoluminescent oxides are conventionally synthesized using sol-gel synthesis and solid-state reaction such as rare-earth doped earth alkali aluminates e.g. $SrAl_2O_4$:Eu/Dy (afterglow) or $BaMgAl_{10}O_{17}$:Eu (blue phosphor) fluoridic materials are synthesized using solvo- or hydrothermal synthesis in teflon-lined pressure bombs.

OPTICAL CERAMICS

Fraunhofer IKTS has a large experience in transparent ceramics based on alumina (α-Al_2O_3), spinell ($MgO{\cdot}Al_2O_3$), zirconia (ZrO_2) und yttria-alumina-garnet ($Y_3Al_5O_{12}$) for many years. These ceramics combine exceptional optical and mechanical properties for armor applications, windows or transparent lenses. Nowadays, optical ceramics functionalized with light converting properties are in the focus of interest for solid-state lighting, laser materials or medical detectors.

Sol-gel synthesized nanoscaled, rare-earth doped yttrium-aluminum-garnet (YAG, $Y_3Al_5O_{12}$) powder has been processed to ceramic discs and optically characterized. The Ce-activated ceramic exhibit a diffuse scattering of white light through the ceramic by excitation with blue laser light.

ADJUSTABLE PROPERTIES

- Single-phase to multi-phase powders and ceramics
- Nano- and µ-size powders
- Specific surface area between 10 and 110 m²/g
- Opaque, semitransparent, translucent and transparent ceramics
- Emission of light with tailored wavelength (up- and down converted)

MATERIALS

- Oxidic, nitridic, oxynitridic and fluoridic phosphor powders
- $SrAl_2O_4$:Eu/Dy (afterglow)
- $BaMgAl_{10}O_{17}$:Eu (blue)
- $NaYF_4$:Yb^{3+}:Er^{3+}/Tm^{3+} (green/blue)
- $Y_3Al_5O_{12}$ (yellow and white)
- $MgO{\cdot}Al_2O_3$, α-Al_2O_3, ZrO_2
- SiC, ZnO (thin films)