Priority Research Area:
Novel materials and technologies for the future MoTiF

The continuous development of novel materials in combination with existing and emerging technologies is the cornerstone for the unprecedented progress in virtually every aspect of life and human activity. The Priority Research Area addresses this challenge by focusing on fast-growing and interdisciplinary research aiming at breakthroughs across all materials and technologies. By bringing together and promoting collaboration between material scientists, chemists, physicists, engineers, and health and life scientists, we aim to provide a platform for the design, fabrication, on-demand properties control and tailored functionality of new, exciting materials and technologies capable of advancing humanity.

Primary disciplinary targets:
Chemistry; Physics; Astronomy; Biology; Materials science; Engineering; Computer Science; Mathematics; Preservation and conservation of cultural heritage.

Thematic range:

Novel materials (both theory and experiment):

- nanostructures: semiconducting, metallic, perovskite;
- 2D materials, dichalcogenides, van der Waals heterostructures;
- metal oxides, metal nitrides;
- nanocomposites: metallic and non-metallic systems, metal-protein complexes, thin layers;
- polymers, OLED materials;
- carbon based materials: fullerene, graphene, graphite nanotubes, quantum dots;
- bio-derived, bio-inspired and biomimetic materials, including biosynthesis, green synthesis, biopolymers and biodegradable materials, bio-fuels, etc.;
- battery components, electrolyzer components, energy storage;
- functional membranes;
- supercapacitors;
- catalysts;
- ionic liquids;
- solid-state scintillators: insulators (perovskites, garnets etc.), semiconductors;
- photoswitches and photochromic materials;

- rare earth-doped materials, self-assembled systems, hybrid nanostructures;
- luminescent and fluorescent compounds;
- supramolecular systems;
- drug delivery systems;
- MOF, dendrimers, and others.

Novel functions and functionalities (both theory and experiment):

- optical data storage;
- data processing;
- photocatalysis;
- water-splitting;
- power generation and energy conversion and storage;
- energy and electron transfer;
- sensing, including biosensing;
- quantum computing;
- coatings and foams;
- plasmonics;
- biomedical compatibility and bioactivity;
- explainable AI;
- energy- and data efficiency;
- quantum communication;
- theranostics;
- cybersecurity;
- machine learning;
- food security;
- non-electrochemical generation of green hydrogen;
- hard-to-heal wounds;
- novel materials for preservation and conservation of cultural heritage.

Technologies of the future (both theory and experiment):

- chemical technologies;
- optical and photonic technologies;
- quantum technologies;
- biomedical technologies;
- bioimaging technologies;

- optical tomography;
- microbiological manipulation for health, technology and ecology;
- advanced digital technologies;
- language technologies;
- preservation and conservation of cultural heritage;
- renewable energy technologies;
- personalized medicine;
- waste disposal;
- lab-on-chip technologies;
- micro- and nanofluidics;
- AI models for fast and efficient molecular and material discovery;
- solar thermal storage technologies;
- nonlinear optical technologies;
- energy conversion and storage technologies;
- photonics, nanotechnology and nanostructure processing;
- big data frameworks;
- AI-powered predictive analytics.