• You need a special designed polymer with unusual structure for a particular application? We will develop a synthesis approach to obtain that polymer including optimization and up-scaling.

• You have already developed a promising stabilizer or flame-retardant at the laboratory scale? We can optimize and up-scale its synthesis so that it will become possible to assess the applicability of the novel substance.

• You are seeking for stabilizers, antioxidants, tougheners or a novel flame retardant? We can synthesize a couple of novel compounds (the structures may be designed by ourselves or given from your company); after selection of promising substances we optimize and scale up the syntheses.

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Fraunhofer LBF’s plastics research division, which evolved out of the German Plastics Institute [Deutsches Kunststoff-Institut DKI], supports its customers along the entire added value chain. We specialize in the management of complete development processes and advise our customers at all stages of development. As an established competence center for additivation-, formulation-, and hybrid issues, we offer comprehensive know-how in the fields of polymer analysis and characterization of properties changes during processing and use, as well as the development of time-resolved processes.
Fraunhofer LBF has gained the special expertise and equipment necessary to synthesize novel polymers, stabilizers, halogen-free flame-retardants and monomers with tailor-made molecular architectures and superior properties. Dedicated working groups are capable of carrying out syntheses and polymerizations even under challenging conditions in reactors and autoclaves with a volume of up to 20 L. Our research projects are conducted in close cooperation with our industrial partners and include the design of appropriate structural features, optimization of reaction conditions as well as up-scaling.

We are your partner in any polymer or additive synthesis development and solve your particular problem efficiently.

**OUR COMPETENCE: DEVELOPMENT OF SYNTHESIS FROM GRAM- TO KILOGRAM-SCALE**

**OUR PARTICULAR EXPERTISE**

Synthesis of polymers with tailor-made architectures, application examples: compatibilizers, coupling agents, dispersing agents, impact modification, morphology control, improved transparency

Examples for established techniques and experiences:
- Living ionic and controlled radical homo- and copolymerizations
- Polycondensations and polyadditions
- Suspension and emulsion polymerizations
- Polymerization of gaseous monomers
- Hydrogenation and functionalization

Synthesis of additives and modifiers, examples: long-term thermal and processing stabilizers, antioxidants, phosphorus-based flame-retardants, tougheners

**OUR SPECIAL EQUIPMENT**

Our "kilogram laboratory" enables the conduction of syntheses under inert conditions in kilogram scale and is equipped with following laboratory apparatus:
- 20-L autoclave: inert conditions, 0–10 bar, -90–250 °C
- Various stainless steel autoclaves: 0–200 bar, -90–400 °C
- Jacketed glass reactors up to 20 L
- Appropriate peripheral equipment
- Sophisticated dosing systems for gases

Characterization and testing of the novel additives and polymers:
- NMR-spectroscopy (including special techniques to characterize polymers)
- GPC, HPLC, special MS methods, thermal analysis (TGA, DSC)
- Preparation and investigation of polymeric samples (bulk, specimens, films...)
- Testing of the efficacy of flame-retardants and stabilizers/antioxidants in plastic materials.

**OUR SERVICE OFFERING**

We offer you to perform the following development work in close corporation with your company:

- You need an optimized polymer-based product or polymer formulation?
  We will support you from trouble shooting over finding solutions, lab- and kilogram-scale synthesis to product testing.