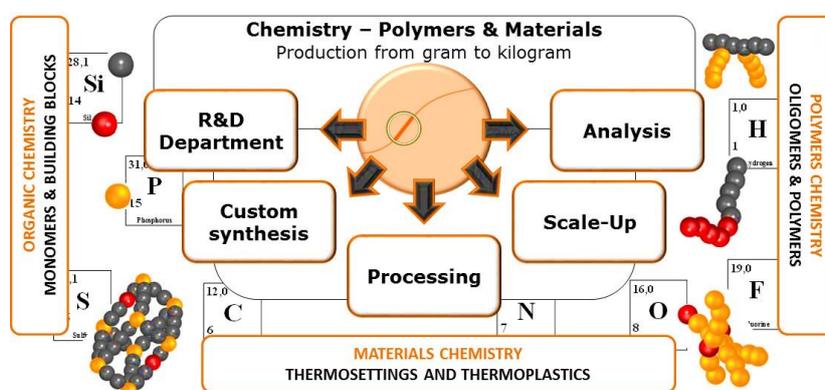


COMPANY PRESENTATION

SPECIFIC POLYMERS (www.specificpolymers.fr, 2003, Castries, FRANCE) is a SME with 12 employees acting as R&D service provider and scale up producer in the field of **functional monomers & polymers with high specificity**. The company was created to meet the need of international high tech industrial groups in terms of specifically designed monomers, oligomers and polymers. The main goal of the innovative product developed by SPECIFIC POLYMERS is, in close collaboration with the customers, to **validate proof of concepts**. In other words, SPECIFIC POLYMERS propose R&D services for academic laboratories and R&D departments of high tech industrial groups. In almost 15 years, SPECIFIC POLYMERS developed the synthesis of more than **10 000 functional building blocks, monomers and polymers** and is now working with more than **500 customers** and partners in more than 35 countries worldwide. Monomers and polymers provided by SPECIFIC POLYMERS are used for a **very wide range of applications** such as surface finishing (glass, metal, metal oxides, nanoparticles, plastics), construction industry, aeronautic, automotive (paint, tyres, sealant, gaskets), pharmaceutical industry, cosmetics, optoelectronic, optic, water treatment, metal extraction, energy (fuel cells, solar cells or lithium batteries).

SPECIFIC POLYMERS activities

- **RESEARCH AND DEVELOPMENT** of innovative polymers
- **ON-DEMAND SYNTHESIS** of building-block, monomers and polymers
- **CATALOG PRODUCTS** supplier (more than 1000 molecules)
- **UP-SCALED PRODUCTION** from gram to kilogram



SPECIFIC POLYMERS

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EXPERTISE DESCRIPTION

SPECIFIC POLYMERS activity consists in the design, the development and the production of:

- **BUILDING BLOCKS:** Chemical characterized by a well-defined structure, composition and functionality that can be used in that state for its physico-chemical properties or used as a precursor for the synthesis of other molecules. Functional groups developed by SPECIFIC POLYMERS are mainly based on the chemistry of phosphorus, silicon, fluorine, epoxy and carbonates but can also be moieties such as amines, alcohols, carboxylic acid, mercaptan, chlorine, bromine, iodine, propargyle, azide, etc.
- **MONOMERS:** Functional molecules bearing polymerizable groups such as (meth)acrylates, styrenic, vinylic, allylic, epoxy, carbonate or maleimides and eventually other functional moieties.
- **POLYMERS:** Macromolecules obtained by polymerization reaction of aforementioned monomers of which the composition, the architecture and the functionality are tuned by mastering the synthesis and polymerization processes used (Free radical polymerization, controlled radical polymerization (RAFT/MADIX, ATRP, NMP), Polycondensation, ionic polymerization, photopolymerization, click-chemistry, high pressure synthesis, polymer functionalization).

Thanks to its **internal research program** and various collaborations with academic and industrial partners, SPECIFIC POLYMERS is developing innovative polymers of great interest in various high tech application fields

SPECIFIC POLYMERS delivers all its polymers with detailed physico-chemical characterizations. SPECIFIC POLYMERS owns **high technology analytical equipments** such as Nuclear Magnetic Resonance (NMR – *Bruker 300 MHz*) ^1H , ^{13}C , ^{19}F , ^{31}P , COSY, 2D DOSY, Size Exclusion Chromatography (SEC – *Agilent technologies, RI, THF*), Differential Scanning Calorimetry (DSC – *TA Instrument Q2000*), InfraRed Analysis (IRTF, *Perkin Elmer – ATR Module*) and Brookfield viscosity (*Brookfield RV Viscosimeter – DV-I Prime*).

SKILLS AND COMPETENCES

- **Organic synthesis**

In order to be able to design polymers with specific functionality, the first step resides in the synthesis of the appropriate monomers or building-blocks. To do so, SPECIFIC POLYMERS has **strong competences and skills in organic chemistry**. Functional groups developed by SPECIFIC POLYMERS are mainly based on the chemistry of phosphorus, silicon, fluorine, epoxy and carbonates but can also be moieties such as amines, alcohols, carboxylic acid, mercaptan, chlorine, bromine, iodine, propargyle or azide. Polymerizable groups developed by SPECIFIC POLYMERS are of all kinds: (meth)acrylates, styrenic, vinylic, allylic, epoxy, amines, cyclocarbonate or maleimides and eventually other functional moieties.

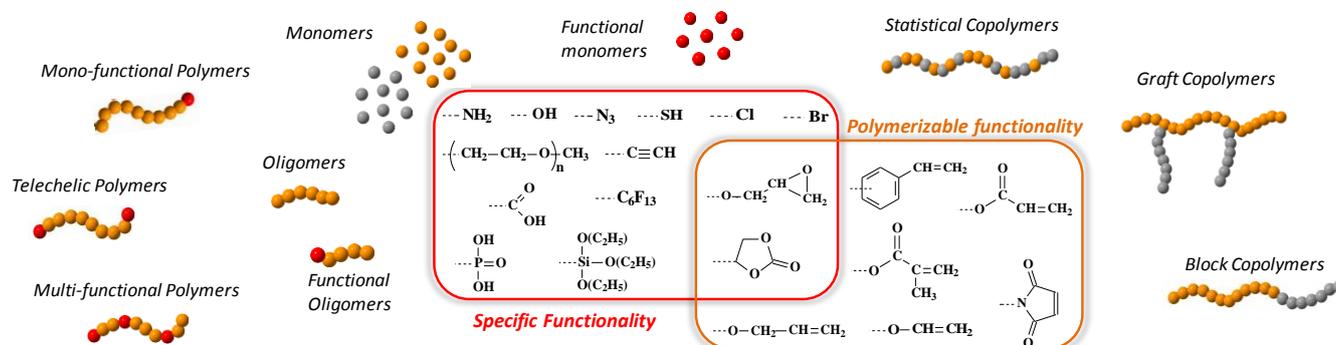
- **Polymer synthesis**

SPECIFIC POLYMERS is able to master the following polymerization methods:

- Free radical polymerization
- Controlled radical polymerization (RAFT/MADIX, ATRP, ARGET ATRP, NMP)
- Radical telomerization
- Polycondensation
- Ionic polymerization (Cationic, Anionic, Ring opening polymerization)
- Photopolymerization (acrylates, epoxy)
- Polymer functionalization
- Click-chemistry
- High pressure synthesis (gaseous monomers, CO₂, H₂)

Mastering such a range of polymerization methods allows SPECIFIC POLYMERS to prepare functional polymers with well-defined composition, architecture and functionality. As for example, SPECIFIC POLYMERS is able to prepare mono-functional telechelic or multifunctional polymers or oligomers. SPECIFIC POLYMERS also has the skills to prepare

polymers with various architectures: statistical copolymers, graft copolymers, block-copolymers, star copolymers, etc....



• Materials

SPECIFIC POLYMERS also have strong competences in the preparation of organic material such as epoxy resins, polyurethanes or phenolic resins. Thanks to our skills in organic and polymer chemistry, SPECIFIC POLYMERS masters most of the crosslinking reactions that enable the preparation of materials: epoxy-amine, epoxy-anhydrid, carbonate-amine, epoxy-phenol, isocyanate-alcohol, azide-propargyle, acrylates-peroxides, acrylate-UV, etc.... Controlling the functionality of the molecules used allow mastering the crosslinking degree and thus the mechanical performances of the corresponding material.

Additionally, SPECIFIC POLYMERS has strong competences in the synthesis of building-blocks, monomers and polymers bearing alcoxysilanes groups. As a consequence, SPECIFIC POLYMERS is involved in various projects based on SOL-GEL materials.

- **Green chemistry**

Green chemistry is a fundamental aspect of SPECIFIC POLYMERS work and many projects are ongoing to find innovative alternatives to fossils resources from the biomass. SPECIFIC POLYMERS research effort is mainly dedicated to:

- **Biobased alternative to Bisphenol-A resins**

SPECIFIC POLYMERS develops the synthesis of various lignin derivatives and special interest was given to Vanillin DiGlycidyl Ether prepared from vanillyl alcohol since it appears as a very promising non-toxic and biobased substituent to DGEBA in epoxy resin formulations (<http://www.specificpolymers.fr/newsletter/article/61>). Up to know, vanillin DGE appears as the most promising candidate to substitute DGE of Bisphenol A at the industrial scale. In addition, vanillin has been shown to be a promising biobased building block for the synthesis of various biobased chemicals for polymer chemistry. It can be extracted from lignin (vanillin-from-lignin process) and chemically modified in a wide range of monomers that can be used to prepare epoxy, polyester or polyurethanes based materials.

- **Biobased alternative to Formophenolic resins**

SPECIFIC POLYMERS currently develop the synthesis of various molecules in order to find biobased substitute to formaldehyde and phenol. Indeed, both those chemicals, which are the main constituent of Formophenolic resins (Novolac/Resol), are highly toxic and dangerous for human health and environment. For several years, SPECIFIC POLYMERS dedicates significant research force to find alternatives from the biomasses that can be relevant in terms of performances and industrializable.

- **Isocyanate free polyurethane resins**

SPECIFIC POLYMERS developed the synthesis of monomers, polymers and building-Blocks containing cyclocarbonate moieties which has shown to be very interesting in the synthesis of non-toxic linear or crosslinked isocyanate-free polyurethanes (<http://www.specificpolymers.fr/newsletter/article/67>).

RESEARCH INFRASTRUCTURE OF THE ORGANIZATION

With a research team composed of 3 PhDs, 5 Engineers and 3 Technicians specialized in organic and polymer chemistry, the whole company is dedicated to research activities. SPECIFIC POLYMERS laboratory equipments includes organic synthesis equipment (grams to kilograms), Polymer synthesis equipment (grams to kilograms) and analyses equipments (Nuclear Magnetic Resonance (*NMR – Bruker 300 MHz*) ^1H , ^{13}C , ^{19}F , ^{31}P , COSY, 2D DOSY, Size Exclusion Chromatography (SEC – *Agilent technologies, RI, THF*), Differential Scanning Calorimetry (*DSC – TA Instrument Q2000*), InfraRed Analysis (*IRTF, Perkin Elmer –ATR Module*) and Brookfield viscosity (*Brookfield RV Viscosimeter – DV-I Prime*)).

Since 2010, SPECIFIC POLYMERS experience a substantial growth that led to its recent move to its own building and consequently to considerably increase its workspace (more than 600 square meters of working space). Such a space allows developing R&D and analytical activities but also permit to settle an activity of formulation and processing (spin-coating, bare-coating, photopolymerization conveyor).(<http://www.specificpolymers.fr/newsletter/article/54>)



Spin-coating



Bare-coating



UV-Polymerization

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