

SPECIFIC POLYMERS

*Your R&D partners in the field
of polymers and materials*



**Company
Overview**



COMPANY PRESENTATION

With over 20 years of experience, SPECIFIC POLYMERS is a French SME with 31 employees acting as R&D services' provider in the field of **functional monomers, polymers, coatings and materials with enhanced performances**. The company was created to meet the need of international stakeholders by filling the gap between academic and industrial research. For many years, major industrial groups and academic laboratories worldwide have relied on its technical skills to **validate their proof-of-concepts**.

Thus, in close collaboration with our customers and partners, SPECIFIC POLYMERS offers a whole set of R&D products and services aiming at the design and the development of innovative technologies. Its mission is to support its clients from the identification of their needs to the industrialization of the most promising solution.

Due to the diversity of its knowledge, activities and application fields, the company has the capacity to provide cross-fertilization and breakthrough innovations. Finally, by mastering all the stages involved in the design of tomorrow's materials, SP team can **bring your ideas one step further**.

Expertise

Created in **2003** in Montpellier | **+19** years of expertise

Turnover

Annual turnover 2021: **1.6 M€** | **+20%** from 2020 to 2021

International

Collaboration in **+50** countries | **49%** of the production exported



Team

31 employees | 10 PhDs, 12 Engineers, 3 Technicians, 6 Adm

Customers

+500 customers & partners worldwide | Industrials & Academics

R&D Products

+10.000 products developed | **+ 500** R&D products in our portfolio

Since its inception, SPECIFIC POLYMERS has already designed more than **10 000 innovative (macro)molecules** for over **500 customers** and partners in more than **50 countries**. The products and programs developed are used for a very wide range of applications such as surface finishing (glass, metal, metal oxides, nanoparticles, plastics), construction (concrete, glass, wood), aeronautic, automotive (paint, tyres), pharmaceuticals (drug delivery, nanomedicine), cosmetics, electronics, optics, water treatment, or energy (fuel cells, solar cells or lithium batteries).

SPECIFIC POLYMERS

 specificpolymers.com

 contact@specificpolymers.fr





ACTIVITIES AND R&D SERVICES

Your support from the design to the production - SPECIFIC POLYMERS meets your outsource research needs by ensuring the feasibility and the confidentiality within the set deadlines of your project. It is positioning as a partner to meet your challenges and guarantees you a detailed and continuous monitoring of progress coupled with ongoing assistance.

With a research team composed of 7 PhDs, 12 engineers and 3 technicians specialized in organic, polymer and materials chemistry, SPECIFIC POLYMERS offers a wide range of R&D activities:



- **R&D PRODUCTS** > – to provide a wide range of innovative R&D products (> 1000 molecules)
- **CUSTOM SYNTHESIS** > – to deliver building-blocks, monomers and polymers
- **CUSTOM MATERIALS FORMULATION** > – to deliver build-to-spec. resins
- **COLLABORATIVE PROJECTS** > – to bring our expertise in polymer and material science
- **RESEARCH PROGRAMS** > – to deliver matter and validate you proof of concept
- **ANALYSIS SERVICES** > – to understand structure/performance/properties relationship
- **SCALE-UP SUPPORT** > – to optimize synthesis processes to bring them from lab to pilote



Synthesis

Innovative
(Macro)molecules

Formulation

Build-to-Spec.
Resins



Design Office

Polymers &
Materials Designer



Physico- Chemical Characterization

Structure-Property-
Performance Relationships



Industrial Transfer

Scale-up Support

Numerical modeling Structure-property

Structure-property relationships
and Materials understanding



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OUR VALUES

At SPECIFIC POLYMERS, we believe our main mission is to satisfy our consumers. Whatever your need, we are devoted to support your innovative projects.

Safety



Customer Centricity



Business Ethic



Reactivity



Integrity



SAFETY: We are aware of the security concerns regarding our R&D activities in chemistry. We make a point of providing our employees and customers the safest working conditions. It is the main concern of SPECIFIC POLYMERS. In all aspect of our R&D activities, a specific attention is given to safety in our lab regarding the synthesis we are developing. More, we are also paying a lot of attention to our employee's well-being. Also, a specific concern is given to consider the environment in all our research (substitute chemicals to reduce environmental footprint, consider life cycle assessment recommendation, switch from petro-sourced to bio-sourced raw materials).

CUSTOMER CENTRICITY: We put our customers at the heart of our concerns, we find tailor-made solutions to move forward together, deliver matter to validate proof-of-concept and finally to reach the initial objectives.

BUSINESS ETHIC: All projects are protected by an NDA and we do not get involved in similar projects with new clients competing with our current customers. We consider with great respect their concerns in their field of application and we adapt accordingly.

REACTIVITY: We are passionate about people and performance; we act for a continuous development & optimization of our solutions in close relationship with our customers. We offer flexibility in our research programs that could be redirected for the good of the project.

INTEGRITY: We make a point of providing to our customers the most reliable scientific results by highlighting our success but also the encountered difficulties. We ensure the best working environment; we share and act with transparency for each of our customers.





MAIN RESEARCH AREAS

SPECIFIC POLYMERS is working on organic, polymer and material chemistries in all fields of applications. However, the company dedicates significant R&D efforts towards 4 main research areas:

1. High Performances Materials & Coatings
2. Environment
3. Energy
4. Health

These thematic areas correspond to SP's philosophy geared toward more responsibly designed materials for human health and environmental protection. **High performance materials and coatings** developed by the company aim at substituting current materials with more efficient ones in terms of performance but also to reduce the environmental impact of corresponding end-products. For instance, high thermo-mechanical performance resins and functional coatings developed by SP allow to design future aircrafts for which heavy metallic parts will be substituted by composite materials and functional coatings. Corresponding weight reduction would finally lead to lower fuel consumption and CO₂ emission. This strong positioning toward environmentally friendly technologies is strengthened by our involvement in **biobased materials & sustainable chemistry** and **polymers & materials for tomorrow's energies** fields. Within these areas, our researchers are working hard to find sustainable alternatives to current petro-based technologies and materials that are detrimental to the environment. Finally, human well-being and health is also at the center of all our concerns. In the **polymers & materials for the Biomedical field** area, we are working in close collaboration with various stakeholders in the health sectors to develop innovative drugs, theragnostic agents or biocompatible & biodegradable materials.





High Performance Materials & Coatings

High performance materials & coatings SPECIFIC POLYMERS focuses on R&D toward high performance materials and coatings for high-demanding applications such as aeronautic or aerospace. High thermal resistance: SP is addressing here the chemistry of the next generation thermoset resin such as bismaleimides, polyimides, cyanates ester, benzoxazines and phthalonitriles to develop composite materials that combine simultaneously the lightweight of organic materials with high the thermal resistance of metallic materials. Functional coatings: SP can custom designed coatings exhibiting various set of properties such as hydrophilicity, hydrophobicity, superhydrophobicity, fire-proofing or high electrical conductivity. Our coatings can be based on various chemistry (sol-gel, UV-cured, epoxy, PU, etc.) and can be customized designed based on our customer specifications.



[For more information](#)

Corresponding Factsheets: [High Performance Thermosets >](#) | [UV Curable Materials >](#)

Corresponding Project: [PIEZOMAT >](#) | [MARCHE >](#) | [FOCEA >](#) | [E-PROT >](#) | [RECORT >](#)

Environment

Green material chemistry and biomass valorization is a fundamental aspect of SP R&D activities. Many industrial and collaborative projects are ongoing to find bio-based alternatives to fossil resources having an industrial viability. Indeed, our research efforts are mainly dedicated to (i) Bio-based building-blocks to substitute toxic and petro-based Bisphenol-A in epoxy resins, (ii) Cyclocarbonates for the synthesis of polyurethanes to replace toxic isocyanate and (iii) End-of-life phase of thermoset materials which own a lack of reprocessability, reparability & recyclability.



[For more information](#)

Corresponding Factsheets: [Bio-based Epoxy Resins >](#) | [Epoxidized Vegetable Oils >](#) | [Cyclocarbonates >](#)

Corresponding Projects: [ECOXY >](#) | [BAMCO >](#) | [BIZENTE >](#) | [VIBES >](#) | BIOVANILLIN | GREENART |



Polymers & Materials for tomorrow's energy devices

In 2019, SP dedicated a significant research effort in the development of innovative ingredients for the next generation of lithium batteries and fuel cells. Lithium batteries: SP contributes to the development of tomorrow's lithium batteries by the production of a large range of lithium salts (TFSI-Li), conductive polymers, additives and plasticizers. Being able to design and synthesize such variety of innovative components



allow SP to be involved in the development of gel polymer electrolyte (GPE) or solid polymer electrolyte (SPE). Fuel Cell: main SP focus is the development of energy-cost-efficient and high throughput synthetic strategies for the preparation of polymeric particles. SP is specialized in the production of silica nanoparticles grafted poly(4-styrenesulfonic acid) as innovative & suitable substitute to the Nafion® polymers in fuel cell membranes.

For more information

Corresponding Factsheets: [Lithium Battery >](#) | [Fuel Cell >](#)

Corresponding Projects: [MEMFOS >](#) | [EXALAME >](#) | [PREMHYOME >](#) | [HIDDEN >](#) | PSIONIC | SOLID

Polymers & Materials for the Biomedical field

For more than 10 years, SP is involved in project targeting application in the biomedical field. Nanomedicine: SP developed poly(ethylene glycol) based functional polymers of interest for the implementation of nanoparticles or luminescent particles for applications like magnetic resonance imaging, stroke treatment or disease cells diagnosis. Drug delivery: SP masters most controlled radical



polymerization technics and developed the synthesis of various amphiphilic polymers of interest for the encapsulation and the delivery of API (Active Pharmaceutical Ingredients). Biodegradable polymers: SP is able to perform the ring opening polymerization of N-carboxy anhydride, lactide and glycolide to design biodegradable polymers that found interest in drug delivery, coronary stents, dental surgery or tumor therapeutics applications. Photodynamic therapy: Recently, SP starts a new collaboration (Pheophotodyn) for the development of photoresponsive monomers and polymers for photodynamic therapy. Targeted molecules are bearing photodimerizable moieties that are responsive to various wavelength.

For more information

Corresponding Project: [GELLIGHT >](#) | [REPAIR >](#) | [ICONS >](#) | [PHEOPHOTODYN >](#) | [STRIC-ON >](#)



EXPERTISE DESCRIPTION

Organic Chemistry and Polymer Synthesis

The core business of the company is dedicated to the design, the development and the production of building-blocks, monomers and polymers.

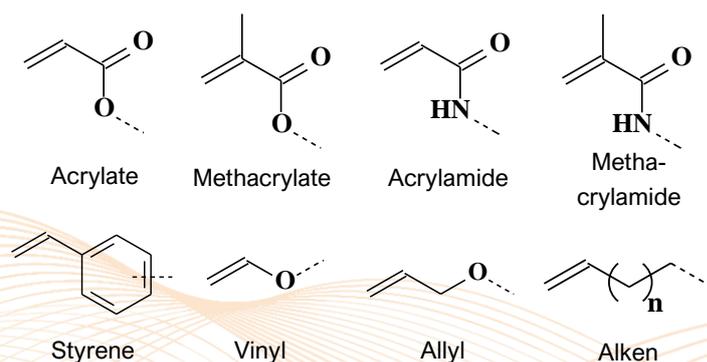
Building-blocks and monomers

In order to be able to design polymers and materials 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.

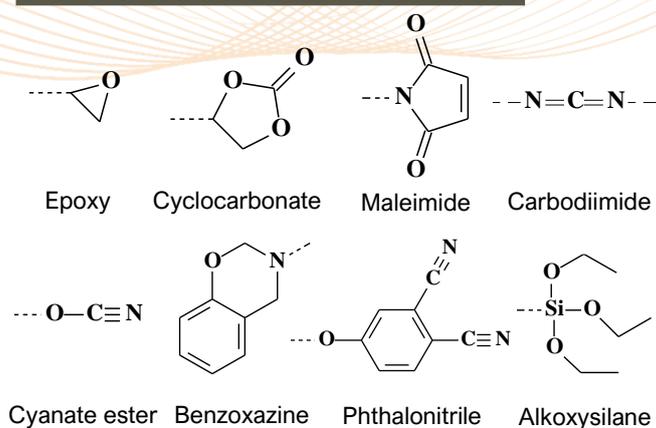
COMMON HETEROFUNCTIONAL GROUPS

---OH Alcohol	---SH Thiol	---NH ₂ Amine	---N ₃ Azide
---F Fluoro	---Cl Chloro	---Br Bromo	---I Iodo
---NCO Isocyanate	---C≡N Nitrile	---C≡CH Propargyl	---C(=O)H Aldehyde

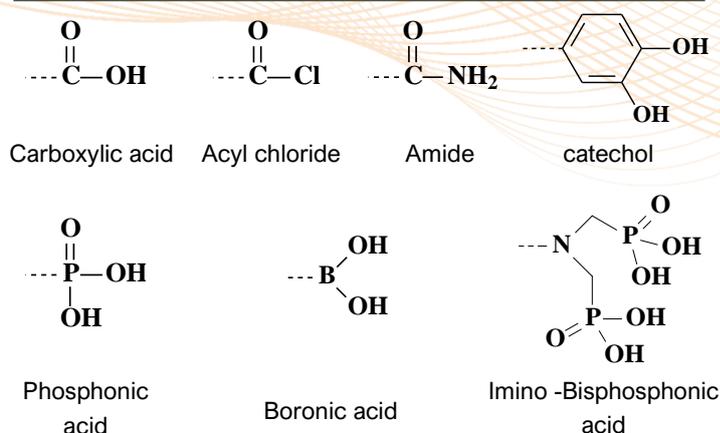
POLYMERIZABLE UNSATURATED BONDS



THERMOSET BUILDING-BLOCKS



ACID & DERIVATIVES - ANCHORING GROUPS



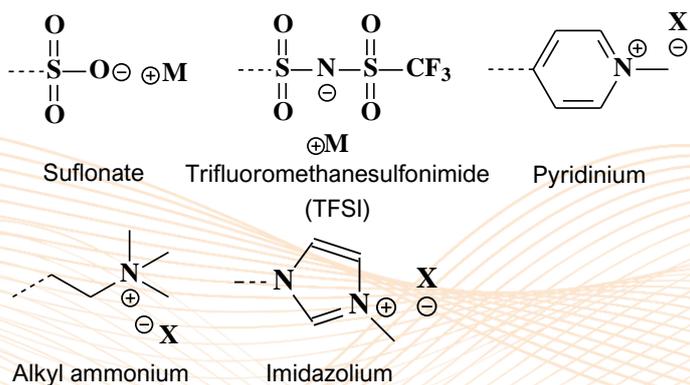
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 contact@specificpolymers.fr

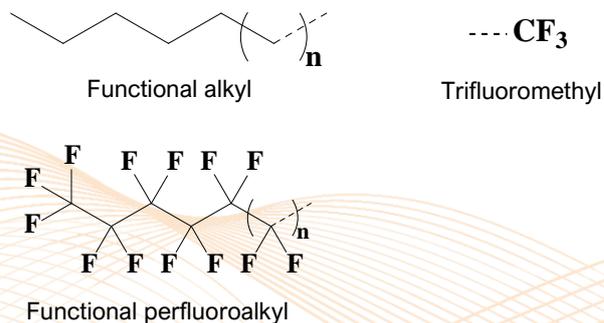




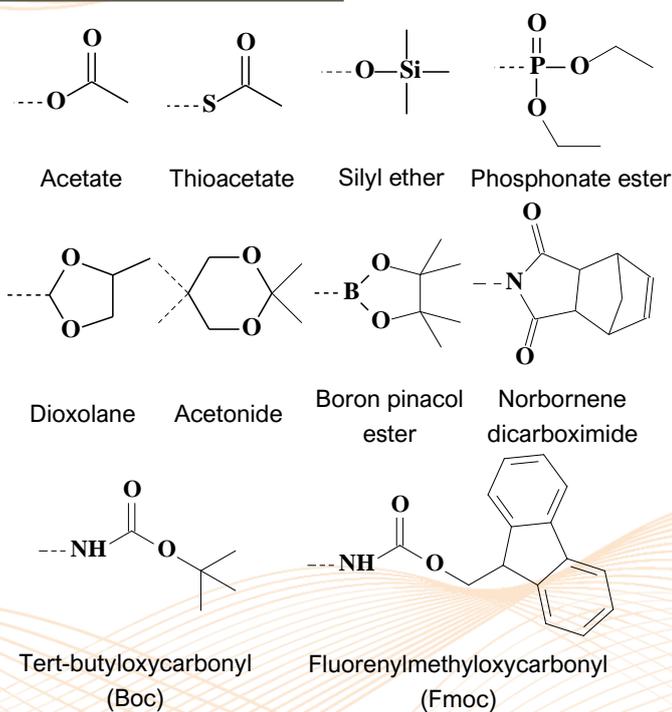
SALTS & IONIC FUNCTIONAL GROUPS



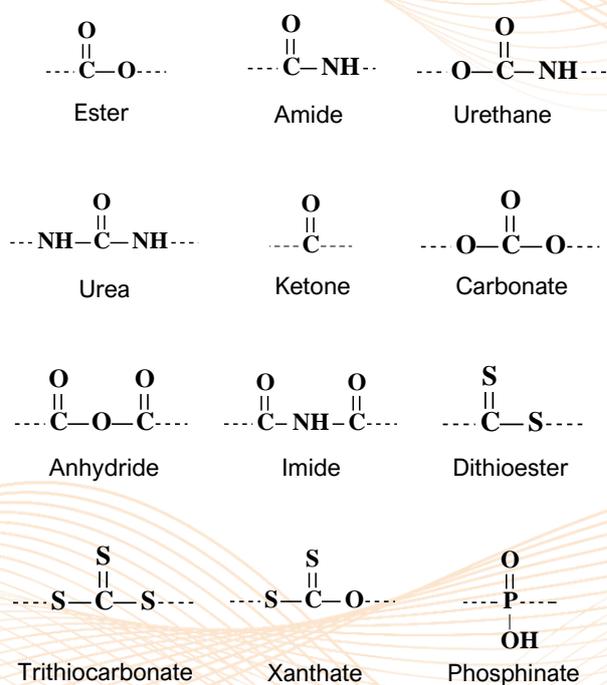
MACROMOLECULAR FUNCTIONAL GROUPS



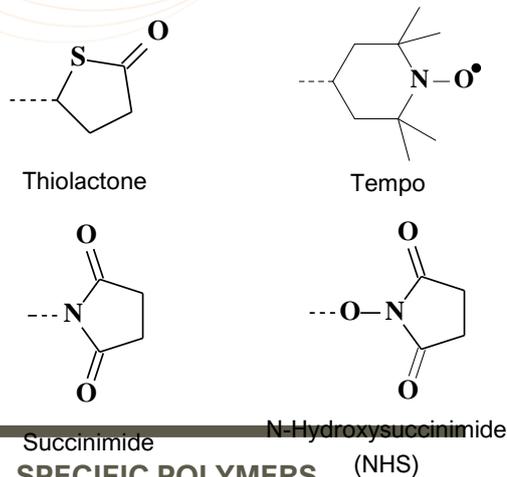
PROTECTING GROUPS



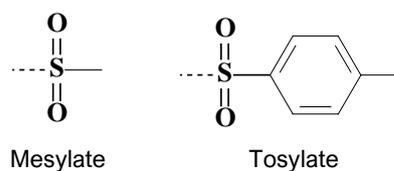
HETERO-FUNCTIONAL LINKAGES



HETEROCYCLIC FUNCTIONAL GROUPS



LEAVING GROUPS



SPECIFIC POLYMERS



***Building blocks:** Chemicals characterized by a well-defined structure, composition and functionality that can be used as such for their physico-chemical properties or used as precursors for the synthesis of other molecules, polymers or materials.

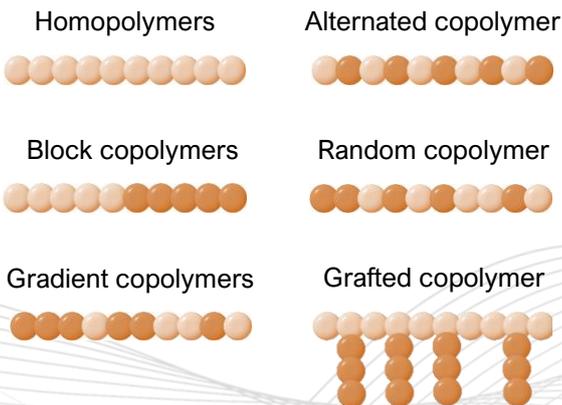
***Monomers:** Functional molecules bearing polymerizable groups such as (meth)acrylates, styrene, vinyl allyl, epoxy, carbonate or maleimides, just to cite a few!

Polymers and Macromolecules

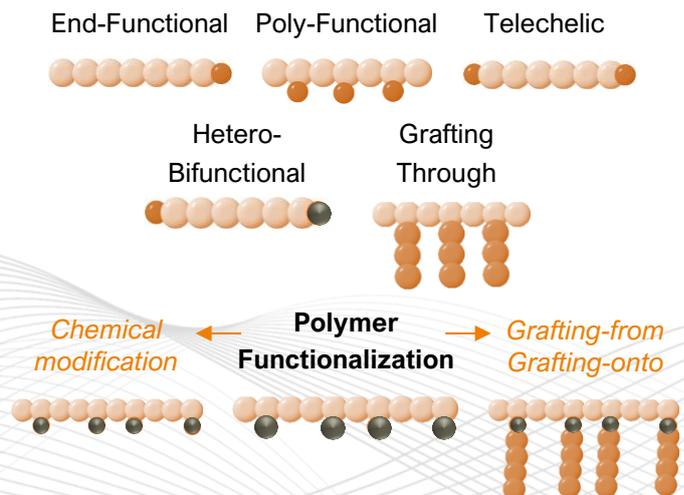
Polymers are macromolecules obtained by polymerization reaction of aforementioned monomers or building blocks for which the composition, the molecular weight, the architecture and the functionality can be tuned by mastering the synthesis and polymerization processes used.

SPECIFIC POLYMERS is able to achieve and implement various polymerization methods such as free radical polymerization, controlled radical polymerization (RAFT/MADIX, ATRP, ARGET-ATRP, NMP), radical telomerization, polycondensation, photopolymerization, polymer post-functionalization, dispersion or emulsion polymerization or ring opening polymerization.

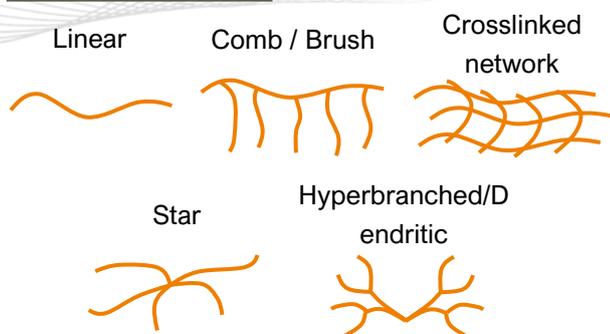
COMPOSITION



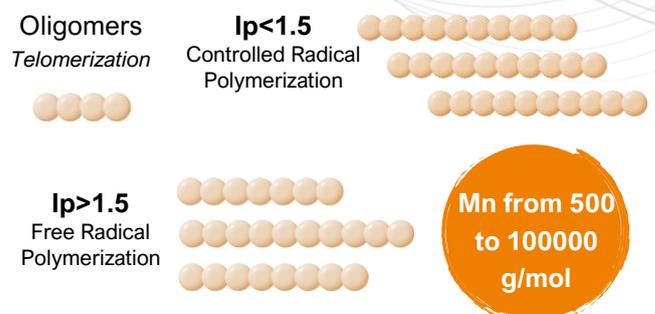
FUNCTIONALITY



ARCHITECTURE



MOLECULAR WEIGHT | DISPERSITY





Knowing such a range of polymerization methods allows SPECIFIC POLYMERS to prepare functional polymers of all kinds. For instance, SPECIFIC POLYMERS is able to prepare mono-functional, telechelic or multifunctional polymers exhibiting various molecular weight. Polymers and copolymers with various architectures (statistical copolymers, graft copolymers, block-copolymers, star copolymers, etc) can also be synthesized based on customer expectations.

In addition, SPECIFIC POLYMERS is working on the synthesis and the chemical modification of a large variety of polymeric chains of interest in many different applications. Our objective is to bring specific functionalities in order to modify the performances of corresponding thermoplastics. [Discover the diversity of our R&D polymers >](#)

Materials & Coatings

Build-to-spec. materials and coating formulations

SPECIFIC POLYMERS opened in 2019 a Formulation, Coatings and Materials Laboratory dedicated to **Tailor-Made innovative Materials** (Thermosets, Hybrid materials, Functional coatings, Composites, Biobased resins, etc.). Thanks to this activity, SPECIFIC POLYMERS wants to go a step further by helping its customers in all the aspects of material developments and by offering build-to-spec. materials synthesis services. Our tailor-made resins are design to fulfill both processes and final materials specifications.

SPECIFIC POLYMERS 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, SP masters most of the crosslinking reactions that enable the preparation of materials: epoxy-amine, epoxy-anhydride, carbonate-amine, epoxy-phenol, isocyanate-alcohol, azide-propargyle, acrylates-peroxides, acrylate-UV, etc. In addition, 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. Our approach is based on an accurate understanding of the crosslinking reaction occurring during the synthesis of materials. We can thus adapt the resin formulation to tune resins properties (viscosity, pot-life, gel-time, etc.) as well as the final thermo-mechanical properties of the thermoset materials (T_g, Young modulus, degradation temperature, surface properties, etc.). For instance, controlling the functionality of the selected building-blocks allow mastering the crosslinking degree and thus tune the thermomechanical performances of the corresponding material. Thanks to our chemical knowledge of a variety of multi-functional (macro)molecules, we can also add specific surface properties to custom design coatings such as hydrophobicity, lipophobicity, conductivity, optical properties or fireproofing properties.





1

THERMOSET MATERIAL CHEMISTRY

Epoxy - Amine

Epoxy - Acid | Anhydride

Epoxy - Phenol

Polyurethanes

Non-isocyanate PU

Acrylic resins

UV curable resins

Sol-gel materials

2

PROCESS SPEC.

Process nature

Infusion, RTM, Pultrusion, etc.

Rheological constraints

Gel point, Pot-life, Viscosity vs. Temp.

Curing Process

Curing time, Curing temperature

3

MATERIAL / COATING SPEC.

Mechanical properties

Tg, Young modulus, etc.

Thermal properties

Degradation temperatures - mechanisms

Surface properties

Hydrophobicity, Lipophobicity, Fireproofing, etc.

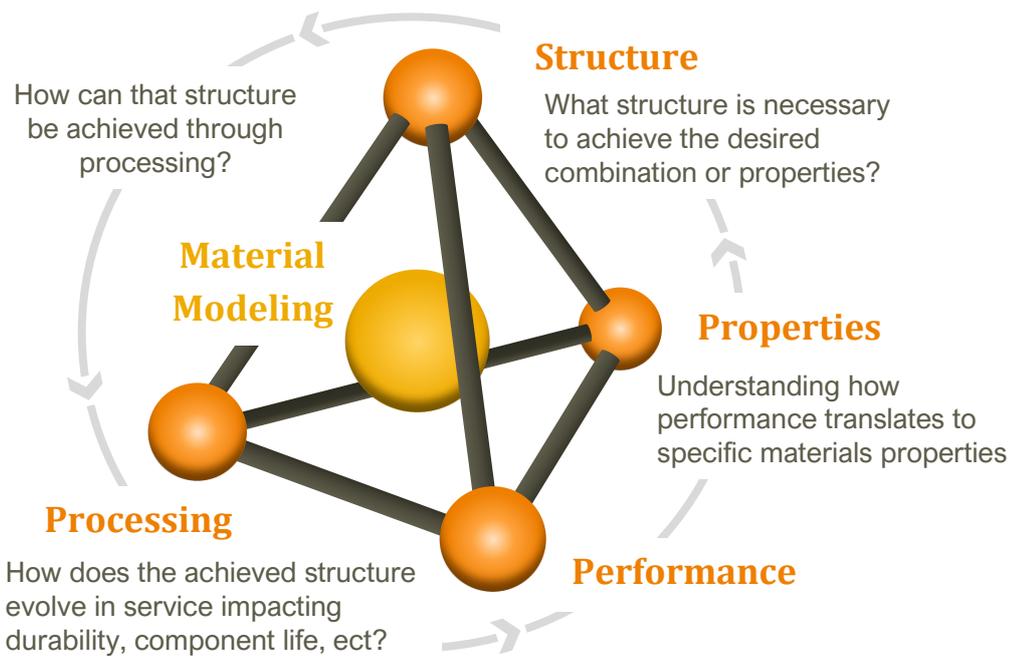
**BUILD-TO-SPEC.
RESIN
FORMULATION**

Even if the targeted markets concern high added values materials and coatings, SP attaches a great importance to the **industrial viability of developed technologies**. Thus, developments are most often based on the formulation of **industrials products from various recognized suppliers**. SP tailor-made additives can also be added to the resin formulation in order to outperform current properties. [Discover the overview of our polymers used in our custom synthesis and materials formulation >](#)

Structure-Properties-Performances Relationships – Material Modeling

Chemical considerations in regard to the industrial products used are often marginalized or neglected by the formulators and applicators and a deep **understanding of the chemistry is a powerful lever to improve material's performances**. With this in mind, SPECIFIC POLYMERS carries out its materials developments on **advanced understanding of structure-properties-processing-performances relationships**. If current developments are mainly based on experimental and analytical competences, SP initiated in 2018 an activity of materials modeling and keeps an eye on artificial intelligence tools (Data learning, Small Data analysis, etc.) to always improve the relevance of its offers.





Research infrastructure of the organization

SPECIFIC POLYMERS owns 600 m² laboratory equipped with high technology units:

Laboratory equipment's

- **Organic & Polymer synthesis equipment** (grams to kilograms): Multi-scale reactors, Magnetic & mechanical stirrers, High pressure reactors, Microwave reactor, Cryothermostats, Typical laboratory Equipments, Speed mixer, etc.
- **Material & Coatings equipment:** Bar-coater, Spin-coater, Custom molds, UV-conveyor, Vacuum oven, High-temperature oven, Brookfield viscosimeter, etc.

Physico-chemical analysis

NMR

Bruker 300 MHz
1H, 13C, 19F,
31P, COSY, 2D
DOSY



SEC

Agilent
technologies,
RI, THF & DMF



TGA

TA Instruments
TGA550



IRTF

Perkin Elmer,
ATR Module



DSC

TA Instrument
Q2000



FOUR-POINT PROBES

Ossila



OCA

Dataphysics,
OCA 50



RHEOMETRE HYBRIDE

HR 20 / TA
Instrument



BROOKFIELD VISCOSITY

RV Viscosimeter,
DV-I Prime



Partners Equipment

High Resolution NMR (600MHz)

SEC - Aqueous Solvents

Elementary Analysis

LCMS – GCMS

MEB - EDX

Dynamic Mechanical Analysis

Tensile Testing

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