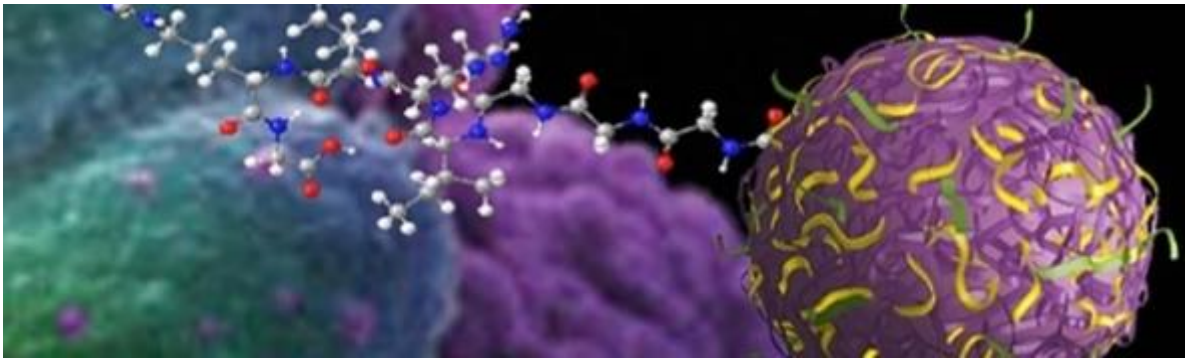
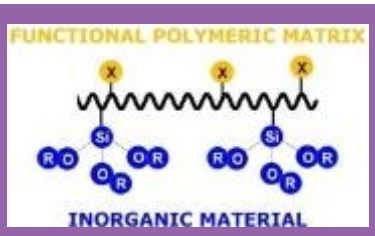
FUNCTIONAL POLYMERS
HYBRID AND COMPOSITE MATERIALS



SPECIFIC POLYMERS research activity mainly focus on organic polymers based materials. Nevertheless, the problematic of **interactions between organic and inorganic matters** has been the subject of numerous studies. Indeed, in most of the cases, the chemical nature of interaction between the inorganic particles and the polymer drives the performance of the resulting system. In this field, SPECIFIC POLYMERS researches are mainly oriented toward (macro)molecules bearing either alcoxysilanes or phosphonated groups. In 2017, SPECIFIC POLYMERS presented its activities in the field within International Conferences.

EUROFILLERS - Heraklion 2017

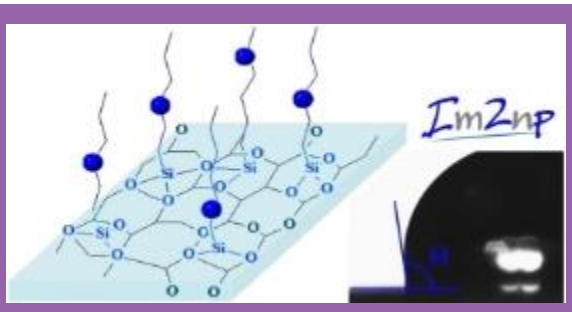
MATERIALS SCIENCE AND ENGINEERING, Rome 2017



ALCOXYSILANE TO LINK SILICA/GLASS SURFACES

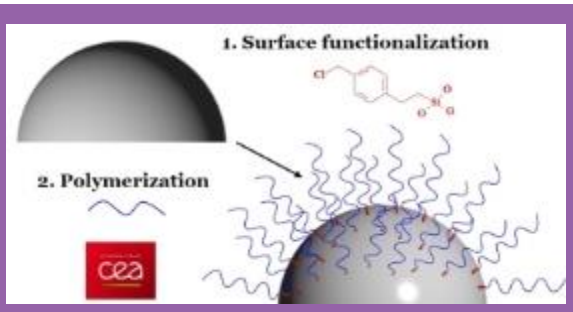
On one hand, polymers bearing alkoxysilane groups are of a great interest for inorganic material surface modification, preparation of functional nanoparticles, or synthesis of sol-gel based hybrid materials. Indeed, the hydroxyl groups located on the inorganic surfaces can react with the alkoxysilanes moieties of functional polymers conducting to hybrid or composite materials exhibiting outstanding properties.

HIGHLIGHTED APPLICATIONS



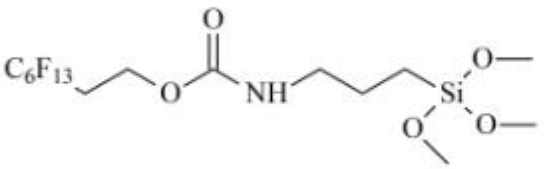
Hydrophobic sol-gel coatings

SPECIFIC POLYMERS is currently developing fluorinated alcoxysilane building-blocks in order to implement hydrophobic sol-gel coatings. Alcoxysilane functionality can react with Tetraethyl orthosilicate in a hydrolyse condensation sol-gel process. Such sol-gel coatings can strongly adhere on surfaces or particles inorganic materials (glass, wafers, etc.) while providing outstanding surface properties. Same strategy can be used to reach other kind of surface properties (hydrophily, thermosensitivity, adhesion, etc.)



Grafted Silica particles

SPECIFIC POLYMERS is working with CEA-Le Ripault (ADEME - PREMHYOME) in order to develop composite fuel cells membrane (PEMFC). Targeted membranes are prepared by inserting poly(sodium 4-styrenesulfonate) grafted silica particles (Si-PSSNa) dispersed in PVDF-HFP polymer matrix. Si-PSSNa particles are synthesized thanks to the grafting of alcoxysilane functional ATRP precusor on the surface of Silica Particles. It then possible to build-up well-defined polymeric coating of any kinds. Such strategy would enable preparing coating a varius chemical nature on silica or other inorganic particles.



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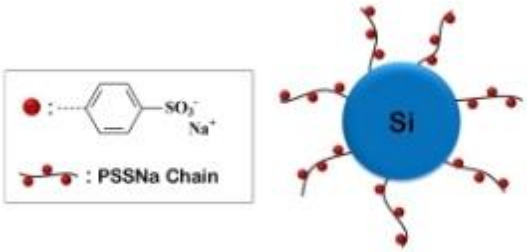
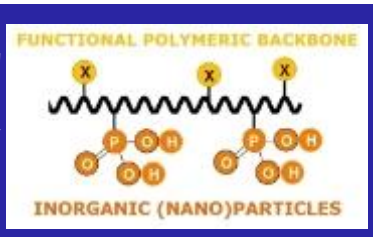


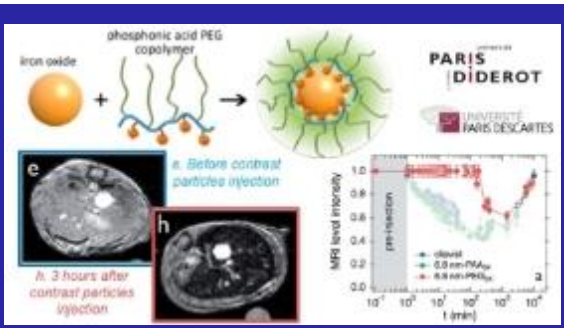
[Si-PSSNa Particles]

PHOSPHONIC ACID TO LINK METAL OR OXIDE



On the other hand, phosphonated groups have the ability to bind metal or metal oxides (iron, aluminium, cerium, titanium, uranium, ITO, gadolinium, nickel, copper, zinc, calcium, quantum dots, nano-metals, etc.) and thus can also be used for functionalization of surfaces or particles.
As for exemple, phosphonic acid functionality was often found to be superior to alcoxysilanes moieties for binding inorganic substrates other than silica, because of the higher robustness and stability of metal-OP over metal-OSi bonds.

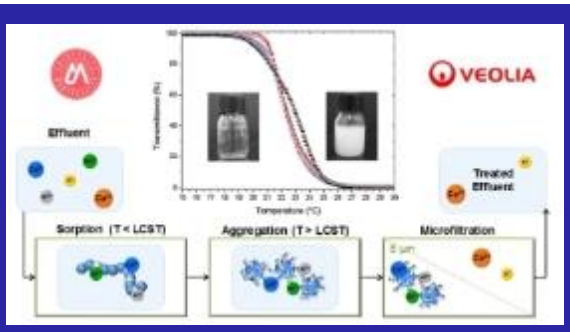
HIGHLIGHTED APPLICATIONS



Polymer coating for FeO2 Particles

SPECIFIC POLYMERS works with Paris Diderot and Paris Descartes University on polymer coated iron oxide particles for MRI Medical Imaging. In this context, SPECIFIC POLYMERS developed a stastical copolymer bearing Pegylated laterals chains for biodistribution and stealthiness and phosphonic acid moeities as polymer coating anchoring groups on the FeO2 particles surfaces. It was prooved that developed coating significantly enhanced the stability of FeO2 particles and allow perfoming MRI medical imaging. These studies are still on-going within the frame of ICONS project.

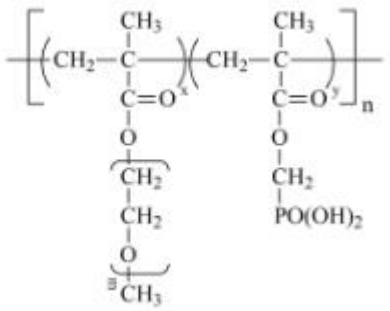
-Ramniceanu et al., RSC Adv., 2016, 6, 63788
-Torrisi, V. et al., Biomacromolecules, 2014, 3171-3179



Polymers for water treatment

Thermosensitive polymers bearing phosphonic acid moieties were developed with Montpellier II University and Veolia in the frame of COPOTERM project in order to implement an innovative water treatment process aiming at the removal of metal cations from wastewater. Phosphonic acid groups allow the selective sorption of aluminium cations at room temperature. A slight increase of the temperature above thermosensitive polymer LCST lead to precipitation of polymer-metal complexe and ease the final separation step (microfiltration).

-Graillot et al., Sep. Purif. Technol., 2015, 141, 17-24
-Graillot et al., J. Hazrd. Mat., 2014, 260, 425-433



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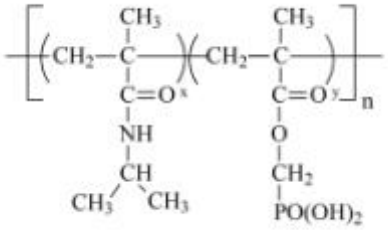

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SPECIFIC POLYMERS offer CUSTOM SYNTHESIS programs

- SPECIFIC POLYMERS can produce **from grams to hundred grams** depending on the targeted molecule.
- All products are delivered with a **synthesis report** including experimental details and analyses.
- Report on the project progress by **regular phone meeting**
- **Feasibility evaluation** can be proposed depending of customer wishes (targeted structures, quantities)

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SP DESCRIPTION

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