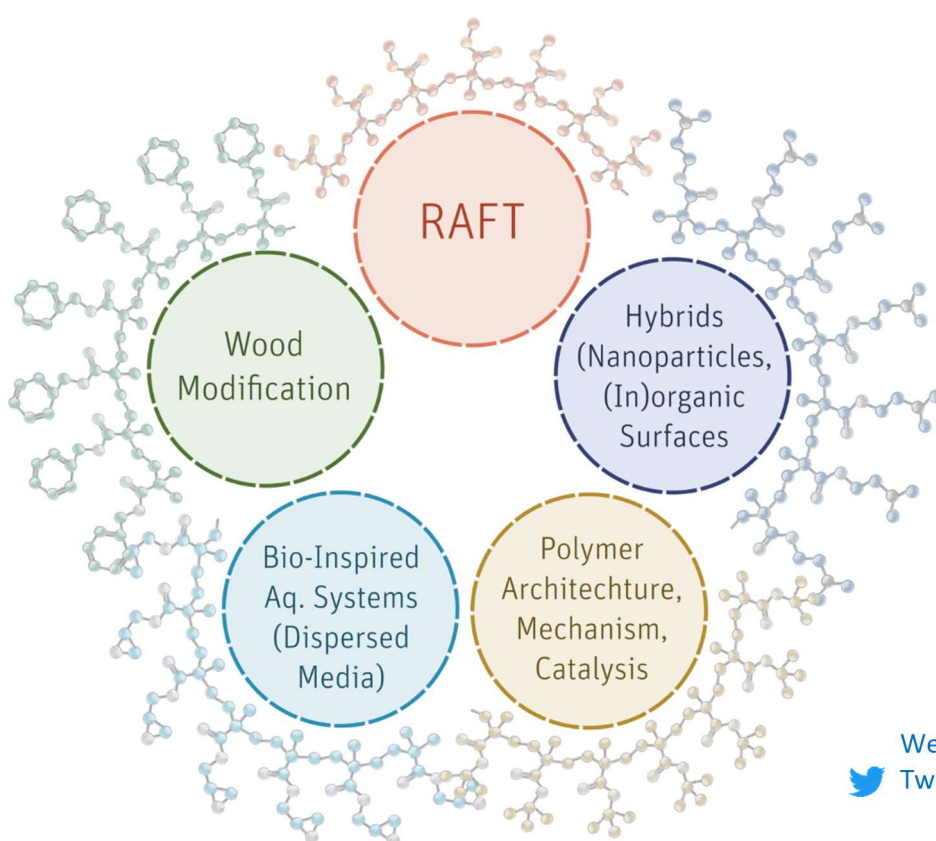



\*\*\*\*\*  
**Prof. Paweł Chmielarz, Eng, PhD, DSc, ProfTit**  
Full Professor  
Head of Department of Physical Chemistry  
Faculty of Chemistry  
Rzeszow University of Technology  
Al. Powstancow Warszawy 6, 35-959 Rzeszow,  
Poland  
Phone: (+48) 178651809  
E-mail: [p\\_chmiel@prz.edu.pl](mailto:p_chmiel@prz.edu.pl)  
Website: <http://pchmielarz.v.prz.edu.pl/en/>  
Twitter: [https://twitter.com/Chmielarz\\_Group](https://twitter.com/Chmielarz_Group)  
\*\*\*\*\*



All rights reserved   
CRG trademark  
Copying and distribution without the consent of the CRG Principal Investigator are forbidden

NEWS

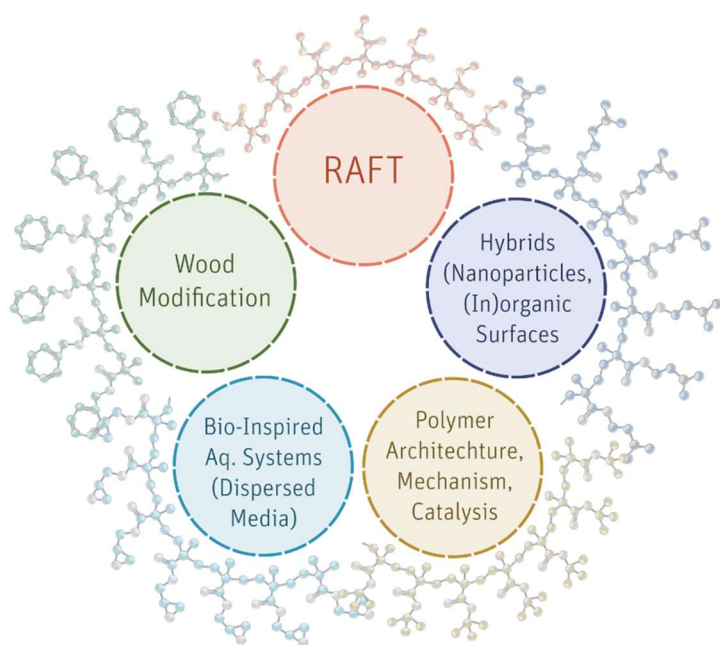
# IUPAC names 10 chemistry innovations that will change the world

BY KATRINA KRÄMER | 3 APRIL 2019

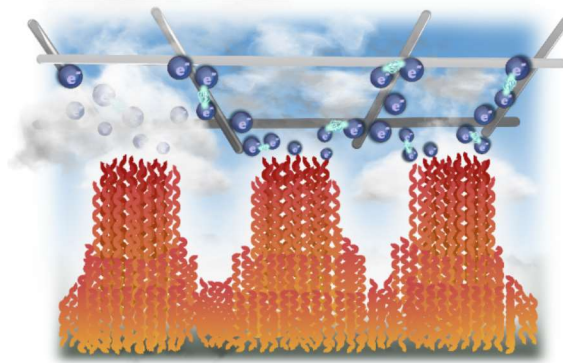
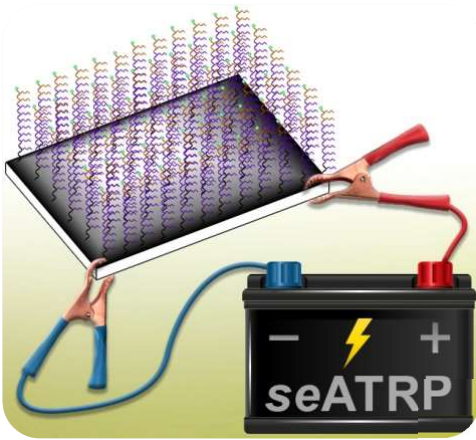
1. Nanopesticides
2. Enantioselective organocatalysis
3. Solid-state batteries
4. Flow chemistry
5. Mechanochemistry and reactive extrusion
6. MOFs
7. Directed enzyme evolution
8. Turning polymers back into monomers
9. **Reversible Deactivation Radical Polymerisation (RDRP)**
10. 3D bioprinting

Gomollón-Bel F.: *Chemistry International* 2019, 41, 12.

21



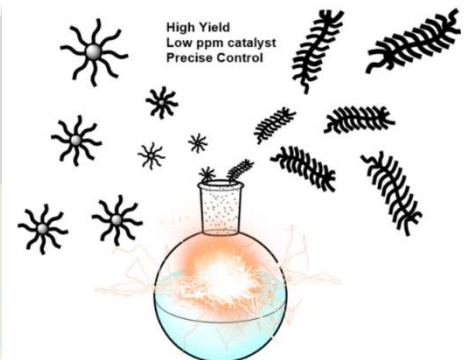
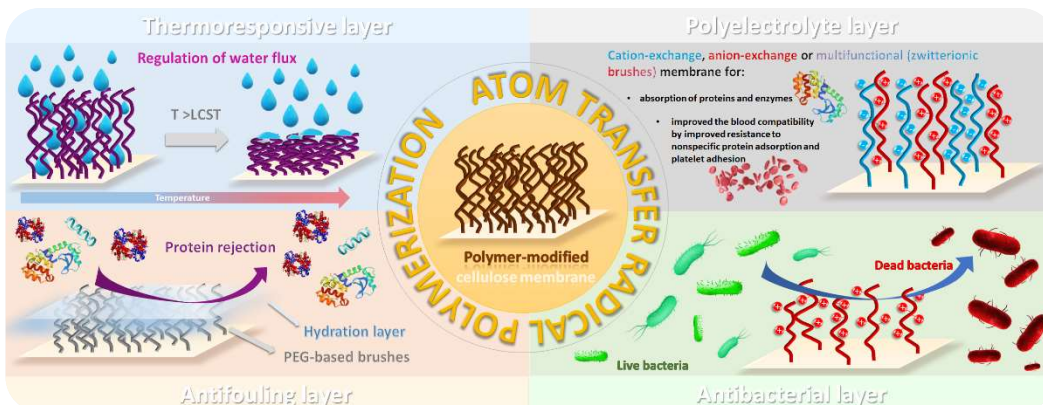
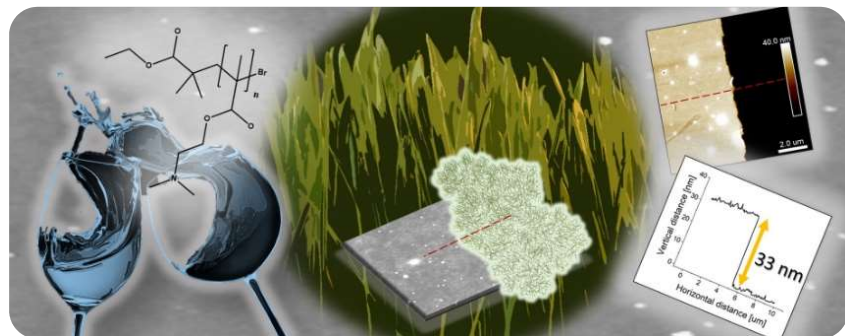
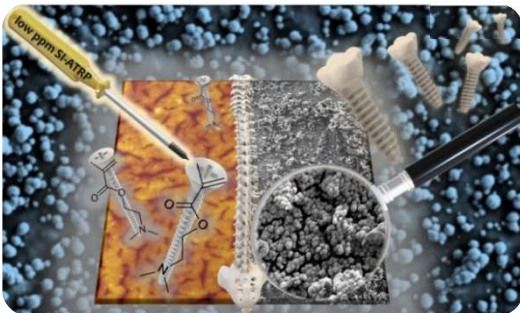
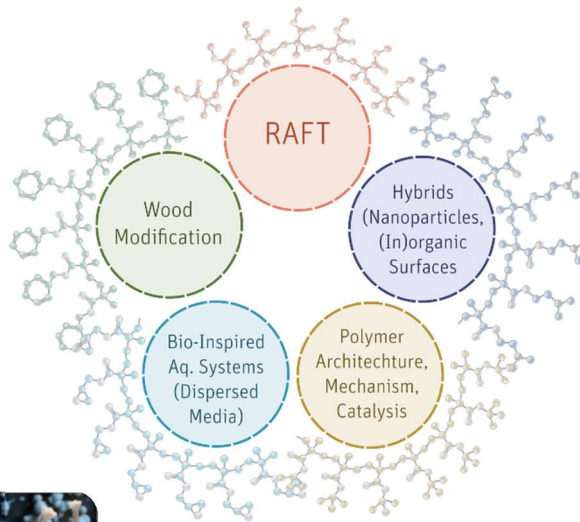




$\mu\text{L}$ -scale SI-seATRP  
diffusion-controlled  
patterned polymer brushes  
ambient conditions

Pt mesh

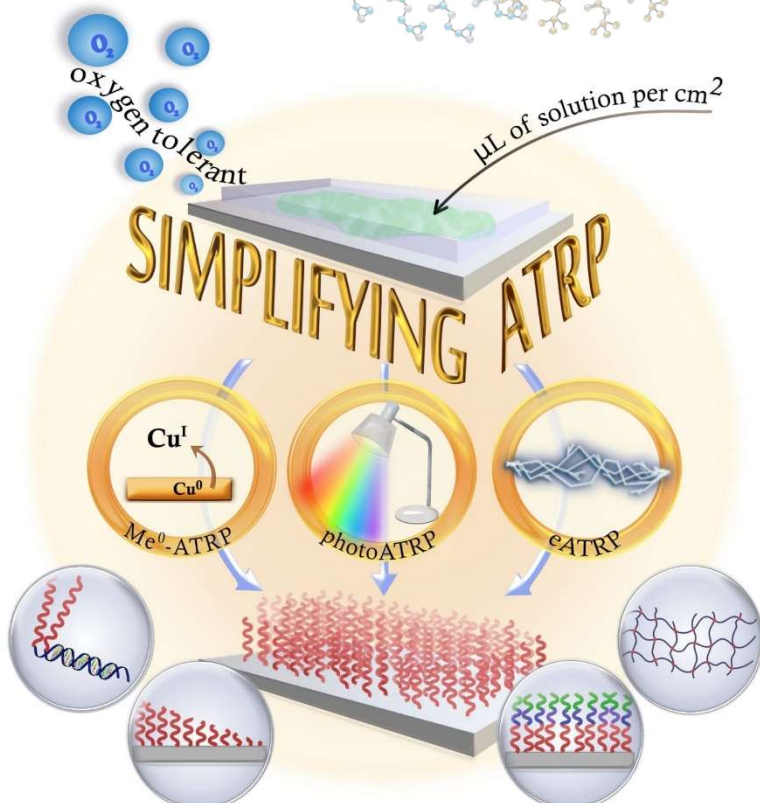
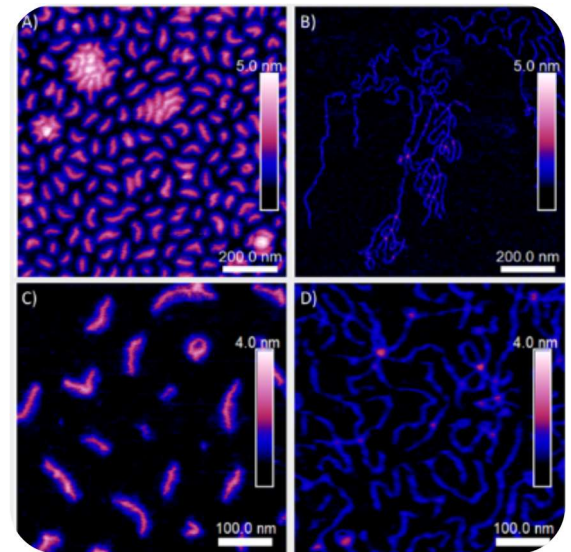
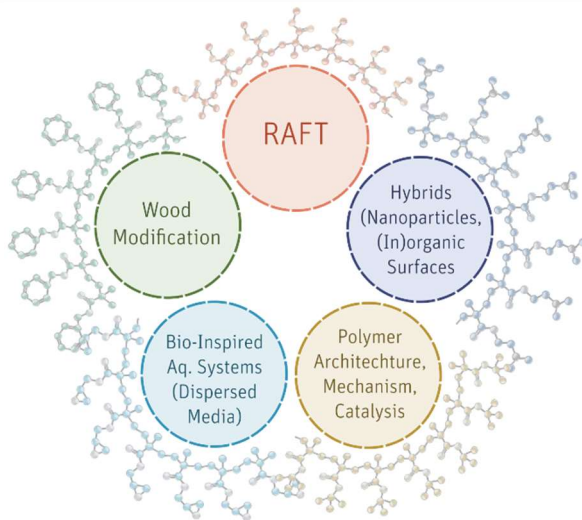
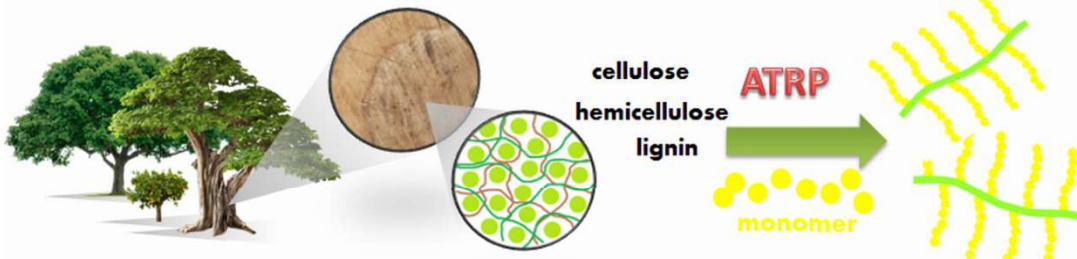
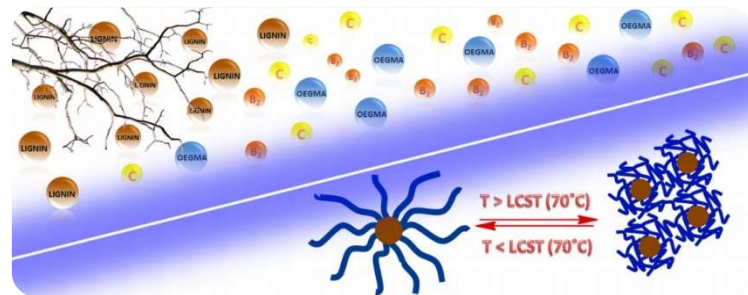
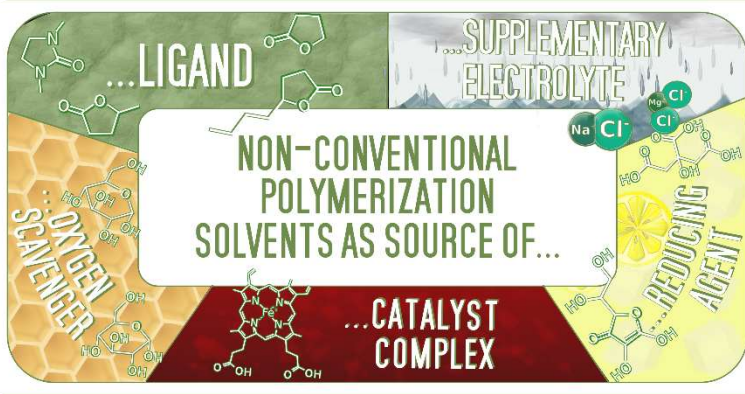
$[\text{BrCu}^{\text{II}}/\text{TPMA}]^+ + \text{e}^- \rightarrow [\text{Cu}^{\text{I}}/\text{TPMA}]^+ + \text{Br}^-$   
Si wafer with initiator









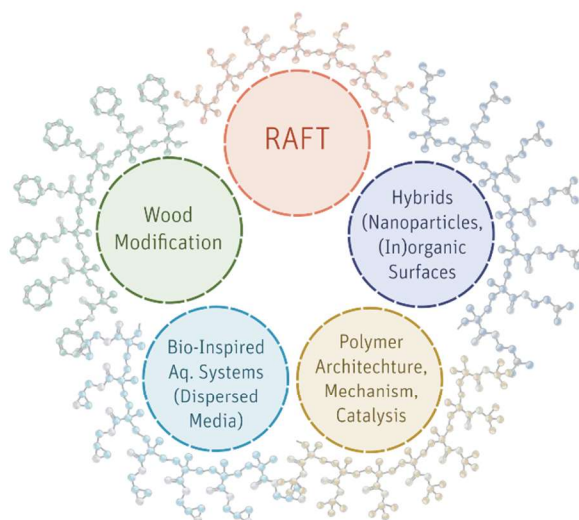




List of projects:

1. Reversible Deactivation Radical Polymerization (RDRP)
2. Synthesis of macromolecular compounds from the surface of wood by ATRP method
3. Modification of membranes by low ppm atom transfer radical polymerization (ATRP) techniques
4. Atom transfer radical polymerization in environmentally-friendly reaction systems
5. Functional hybrid materials designed via low ppm atom transfer radical polymerization
6. Implementation of green chemistry principles in surface initiated atom transfer radical polymerization (ATRP) procedures
7. Electrochemical mediated reversible addition-fragmentation chain-transfer polymerization (eRAFT)
8. The use of naturally-derived substances as photocatalysts in Atom Transfer Radical Polymerization (ATRP)

Duration: 3-6 months



**Table A - Traineeship Programme at the Receiving Organisation/Enterprise**

Planned period of the mobility: from xx/xx/xx to xx/xx/xx

Traineeship title: Reversible Deactivation Radical Polymerization (RDRP)

Number of working hours per week: 30 Hours

**Detailed programme of the traineeship:**

**Synthesis of well-defined polymer architectures by RDRP methods**

Tasks of the trainee:

- 1) Literature review on:
  - Reversible Deactivation Radical Polymerization (RDRP) methods,
  - Influence of different parameters on the polymerization process,
  - Fundamentals of well-defined polymer architectures,
  - Examples of synthesis of well-defined polymer architectures by RDRP methods (2 weeks).
- 2) Synthesis of well-defined polymer architectures by different RDRP methods (4 weeks).
- 3) Determination of the influence of different parameters on the polymerization process (4 weeks).
- 4) Critical evaluation of the results achieved by comparing them with others available in literature (1 week).
- 5) Report production (1 week).

Traineeship in digital skills: Yes  No

**Knowledge, skills and competences to be acquired by the end of the traineeship (expected Learning Outcomes):**

Know how and in what conditions controlled radical polymerization can be conducted.

- Know the methods to be applied in the evaluation of the polymerization progress.
- Know how to conduct reversible deactivation radical polymerizations.
- Know how to determine basic parameters describing well-defined macromolecules.
- Understand RDRP mechanistic aspects and fundamentals of well-defined polymer architectures.

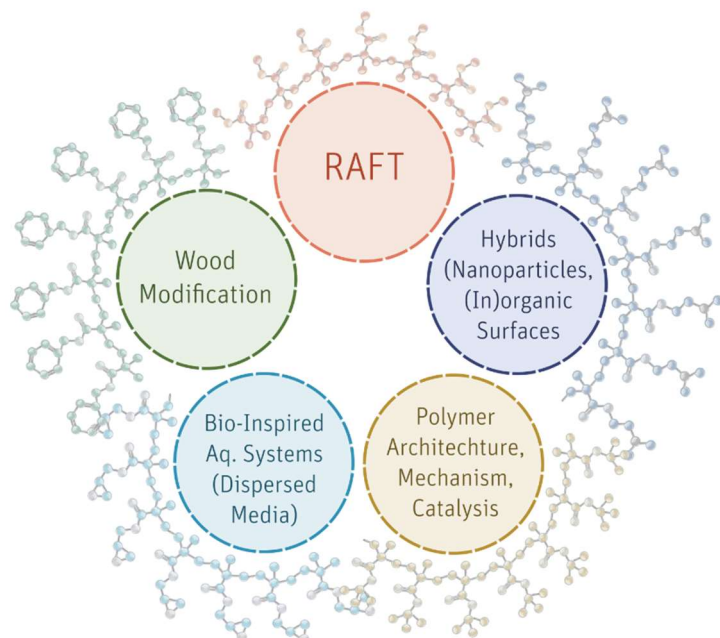
**Monitoring plan:**

The exchange of information about the progress of the placement between sending and host organizations. The student is obliged to inform sending institution about the advancement. Monitoring visit of the people involved in organizing and supervising the mobility (if, necessary). Submitting a report about the course of the placement.

**Evaluation plan:**

For evaluation of the training the following criteria will be taken into account: academic knowledge, analytical skills, foreign language skills, adaptability, communication, teamwork, initiative, decision-making.

The level of **language competence** in \_\_\_\_\_ [indicate here the main language of work] that the trainee already has or agrees to acquire by the start of the mobility period is: A1  A2  B1  B2  C1  C2  Native speaker



**Table A - Traineeship Programme at the Receiving Organisation/Enterprise**

Planned period of the mobility: from xx/xx/xx to xx/xx/xx

**Traineeship title: Synthesis of macromolecular compounds from the surface of wood by ATRP method**

**Number of working hours per week: 30 Hours**

**Detailed programme of the traineeship:**

**Synthesis of well-defined polymer architectures by ATRP methods**

Tasks of the trainee:

- 1) Literature review on:
  - Atom transfer radical polymerization (ATRP) methods,
  - Optimization of the grafting process of polymer brushes from the wood surface,
  - Examples of synthesis of well-defined polymer architectures by ATRP methods on organic surfaces (2 weeks).
- 2) Application of the Soxhlet extraction method to prepare the wood surface for modification. (2 weeks).
- 3) Creation of ATRP initiation sites on the wood surface by means of an esterification reaction (3 weeks).
- 4) Synthesis of well-defined polymer architectures by different RDRP methods (3 week).
- 5) Summary of the obtained results and their comparison with others available in the literature (2 week).

**Traineeship in digital skills:** Yes  No

**Knowledge, skills and competences to be acquired by the end of the traineeship (expected Learning Outcomes):**

Understand the mechanistic aspects of ATRP.

- Know how and under what conditions atom transfer controlled radical polymerization (ATRP) can be carried out.
- Knowledge of the methods used to modify the surface of various types of wood.
- Know how to assess the kinetics of radical polymerization.
- Be able to define the basic parameters for obtaining well-defined macromolecules from organic surfaces.

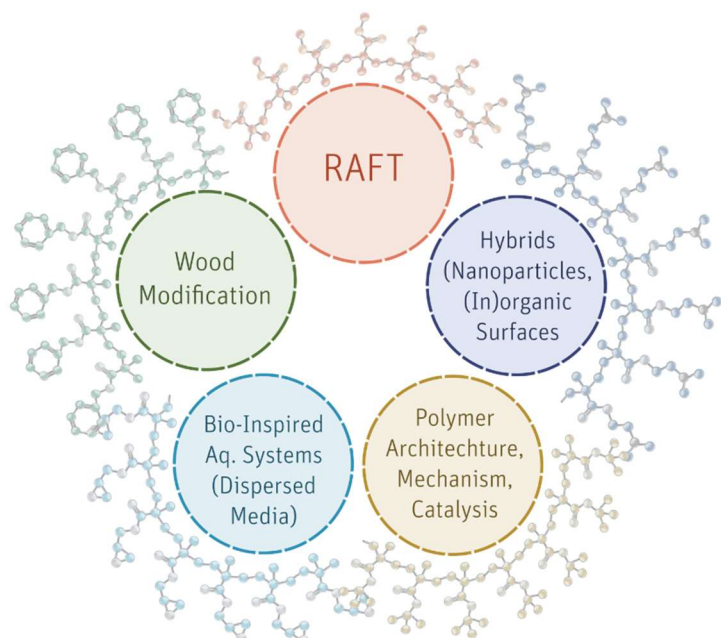
**Monitoring plan:**

The exchange of information about the progress of the placement between sending and host organizations. The student is obliged to inform sending institution about the advancement. Monitoring visit of the people involved in organizing and supervising the mobility (if, necessary). Submitting a report about the course of the placement.

**Evaluation plan:**

For evaluation of the training the following criteria will be taken into account: academic knowledge, analytical skills, foreign language skills, adaptability, communication, teamwork, initiative, decision-making.

The level of **language competence** in \_\_\_\_\_ [indicate here the main language of work] that the trainee already has or agrees to acquire by the start of the mobility period is: A1  A2  B1  B2  C1  C2  Native speaker





**Table A - Traineeship Programme at the Receiving Organisation/Enterprise**

Planned period of the mobility: from xx/xx/xx to xx/xx/xx

**Traineeship title: Modification of membranes by low ppm atom transfer radical polymerization (ATRP) techniques**

**Number of working hours per week: 30 Hours**

**Detailed programme of the traineeship:**

Tasks of the trainee:

- 1) Literature review on the grafting-from approach, low ppm ATRP methods and modification of flat and porous materials by ATRP (1 week).
- 2) Modification of membranes e.g. regenerated cellulose membranes by different RDRP methods (10 weeks).
  - Preparations of ATRP initiators by bromination of raw materials
  - Following the kinetics of the polymerizations by nuclear magnetic resonance (NMR) spectroscopy and gel permeation chromatography (GPC).
  - Determination of the influence of different parameters on the polymerization process.
  - Critical evaluation of the results achieved by comparing them with others available in the literature.
- 3) Report production (1 week).

**Traineeship in digital skills:** Yes  No

**Knowledge, skills and competences to be acquired by the end of the traineeship (expected Learning Outcomes):**

- Ability to the selection of the conditions for atom transfer radical polymerization to conduct the polymerization.
- Knowledge of the methods to be applied in evaluating the polymerization progress.
- Knowledge of the synthetic way for the modification of flat surfaces and porous materials.
- The ability to determine basic parameters describing well-defined macromolecules and following the kinetics of polymerization.
- Knowledge of ATRP mechanistic aspects and fundamentals of well-defined polymer architectures.

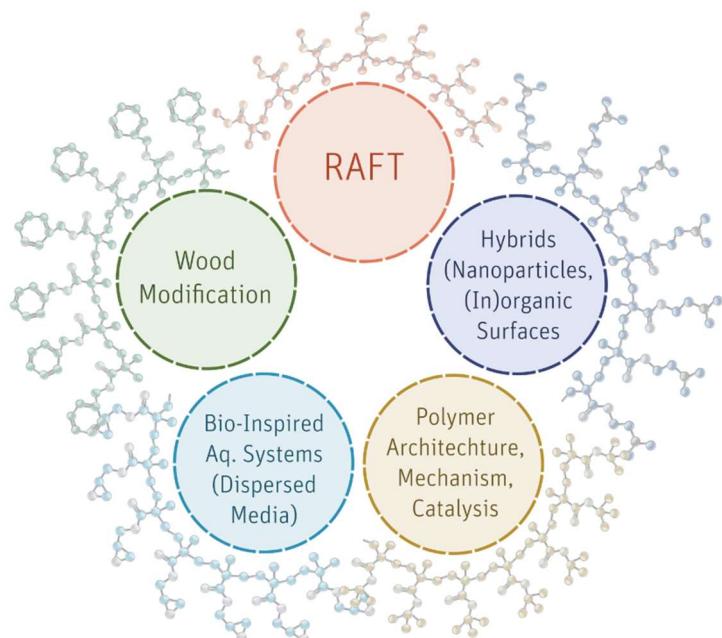
**Monitoring plan:**

The exchange of information about the progress of the placement between sending and host organizations. The student is obliged to inform sending institution about the advancement. Monitoring visits of the people involved in organizing and supervising the mobility (if, necessary). Submitting a report about the course of the placement.

**Evaluation plan:**

For evaluation of the training, the following criteria will be taken into account: academic knowledge, analytical skills, foreign language skills, adaptability, communication initiative, and decision-making.

The level of **language competence** in \_\_\_\_\_ [indicate here the main language of work] that the trainee already has or agrees to acquire by the start of the mobility period is: A1  A2  B1  B2  C1  C2  Native speaker



**Table A - Traineeship Programme at the Receiving Organisation/Enterprise**

Planned period of the mobility: from xx/xx/xx to xx/xx/xx

**Traineeship title: Atom transfer radical polymerization in environmentally-friendly reaction systems**

**Number of working hours per week: 30 Hours**

**Detailed programme of the traineeship:**

Tasks of the trainee:

- 1) Literature review on low ppm and metal-free ATRP methods and environmentally-friendly concepts implemented in ATRP (1 week).
- 2) Synthesis of well-defined polymers with various structures and topologies by different ATRP methods in green solvents and aqueous systems (10 weeks).
  - Polymerization of a wide range of monomers in the different reaction environments.
  - Following the kinetics of the polymerizations by nuclear magnetic resonance (NMR) spectroscopy and gel permeation chromatography (GPC).
  - Determination of the influence of different parameters on the polymerization process.
  - Critical evaluation of the results achieved by comparing them with others available in the literature.
- 3) Report production (1 week).

**Traineeship in digital skills:** Yes  No

**Knowledge, skills and competences to be acquired by the end of the traineeship (expected Learning Outcomes):**

- Ability to the selection of the conditions for atom transfer radical polymerization to conduct the polymerization.
- Knowledge of the methods to be applied in evaluating the polymerization progress.
- Knowledge of the synthetic way for the synthesis of well-defined polymers in various environment.
- The ability to determine basic parameters describing well-defined macromolecules and following the kinetics of polymerization.
- Knowledge of ATRP mechanistic aspects and fundamentals of well-defined polymer architectures.

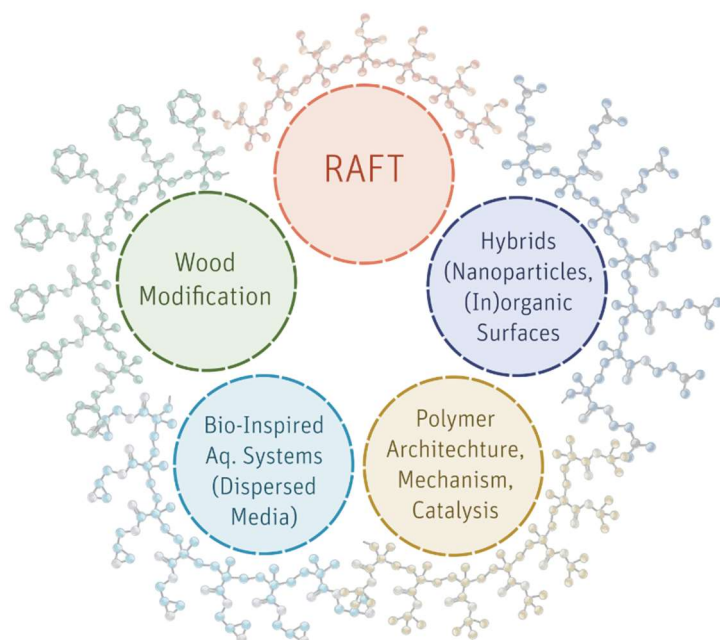
**Monitoring plan:**

The exchange of information about the progress of the placement between sending and host organizations. The student is obliged to inform sending institution about the advancement. Monitoring visits of the people involved in organizing and supervising the mobility (if, necessary). Submitting a report about the course of the placement.

**Evaluation plan:**

For evaluation of the training, the following criteria will be taken into account: academic knowledge, analytical skills, foreign language skills, adaptability, communication initiative, and decision-making.

The level of **language competence** in \_\_\_\_\_ [indicate here the main language of work] that the trainee already has or agrees to acquire by the start of the mobility period is: A1  A2  B1  B2  C1  C2  Native speaker





**Table A - Traineeship Programme at the Receiving Organisation/Enterprise**

Planned period of the mobility: from xx/xx/xx to xx/xx/xx

**Traineeship title: Functional hybrid materials designed via low ppm atom transfer radical polymerization**

**Number of working hours per week: 30 Hours**

**Detailed programme of the traineeship:**

**Functional hybrid materials designed via low ppm atom transfer radical polymerization**

Tasks of the trainee:

- 1) Literature review on:
  - Low ppm Atom Transfer Radical Polymerization (ATRP) methods,
  - Various approaches of surface-initiated atom transfer radical polymerization (SI-ATRP)
  - Library of functional monomers polymerizable via SI-ATRP
  - Examples of materials modified via ATRP methods (2 weeks).
- 2) Synthesis of well-defined polymer brushes via SI-ATRP (4 weeks).
- 3) Determination of the influence of different parameters on the polymerization process (4 weeks).
- 4) Critical evaluation of the results achieved by comparing them with others available in literature (1 week).
- 5) Report production (1 week).

**Traineeship in digital skills:** Yes  No

**Knowledge, skills and competences to be acquired by the end of the traineeship (expected Learning Outcomes):**

Know how and in what conditions controlled radical polymerization can be conducted.

- Know the methods to be applied in the synthesis of functional hybrid materials
- Know how to conduct surface-initiated atom transfer radical polymerization.
- Know how to determine basic parameters describing well-defined polymer brushes.
- Understand SI-ATRP mechanistic aspects

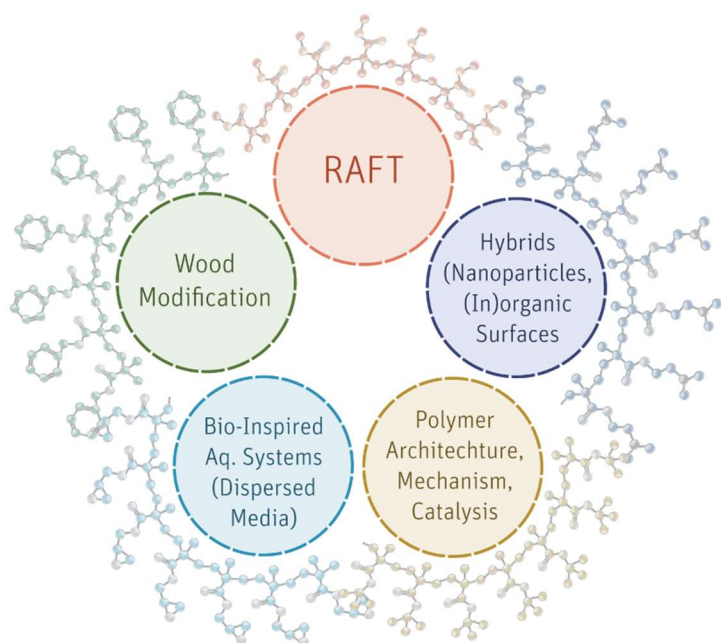
**Monitoring plan:**

The exchange of information about the progress of the placement between sending and host organizations. The student is obliged to inform sending institution about the advancement. Monitoring visit of the people involved in organizing and supervising the mobility (if, necessary). Submitting a report about the course of the placement.

**Evaluation plan:**

For evaluation of the training the following criteria will be taken into account: academic knowledge, analytical skills, foreign language skills, adaptability, communication, teamwork, initiative, decision-making.

The level of **language competence** in \_\_\_\_\_ [indicate here the main language of work] that the trainee already has or agrees to acquire by the start of the mobility period is: A1  A2  B1  B2  C1  C2  Native speaker



**Table A - Traineeship Programme at the Receiving Organisation/Enterprise**

Planned period of the mobility: from xx/xx/xx to xx/xx/xx

**Traineeship title: Implementation of green chemistry principles in surface initiated atom transfer radical polymerization (ATRP) procedures**

**Number of working hours per week: 30 Hours**

**Detailed programme of the traineeship:**

**Implementation of green chemistry principles in surface initiated atom transfer radical polymerization (SI-ATRP) procedures**

Tasks of the trainee:

- 1) Literature review on:
  - Low ppm atom transfer radical polymerization (ATRP) methods,
  - New trends in non-conventional solvents for polymer production,
  - Fundamentals of well-defined polymer architectures,
  - Examples of implementation green chemistry aspects in polymer synthesis (2 weeks).
- 2) Synthesis of well-defined polymer brushes via low ppm ATRP methods inspired by green chemistry (4 weeks).
- 3) Analysis of physicochemical properties of synthesized polymer brushes (4 weeks).
- 4) Critical evaluation of the results achieved by comparing them with others available in literature (1 week).
- 5) Report production (1 week).

**Traineeship in digital skills:** Yes  No

**Knowledge, skills and competences to be acquired by the end of the traineeship (expected Learning Outcomes):**

Know how and in what conditions controlled radical polymerization can be conducted.

- Know the methods to be applied in the synthesis of well-defined polymer brushes
- Know how to conduct surface-initiated atom transfer radical polymerization inspired by green chemistry
- Know how design innovate novel procedures for polymer synthesis
- Identify and define the directions of development of ATRP techniques, taking into account recent scientific trends

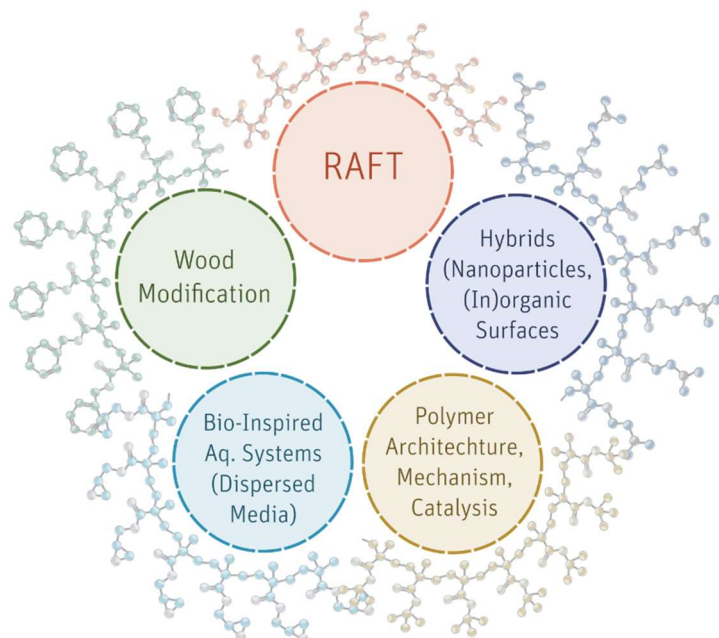
**Monitoring plan:**

The exchange of information about the progress of the placement between sending and host organizations. The student is obliged to inform sending institution about the advancement. Monitoring visit of the people involved in organizing and supervising the mobility (if, necessary). Submitting a report about the course of the placement.

**Evaluation plan:**

For evaluation of the training the following criteria will be taken into account: academic knowledge, analytical skills, foreign language skills, adaptability, communication, teamwork, initiative, decision-making.

The level of **language competence** in \_\_\_\_\_ [indicate here the main language of work] that the trainee already has or agrees to acquire by the start of the mobility period is: A1  A2  B1  B2  C1  C2  Native speaker





**Table A - Traineeship Programme at the Receiving Organisation/Enterprise**

Planned period of the mobility: from xx/xx/xx to xx/xx/xx

**Traineeship title: Electrochemical mediated reversible addition-fragmentation chain-transfer polymerization (eRAFT)**

**Number of working hours per week: 15 Hours**

**Detailed programme of the traineeship:**

**Synthesis of polymers by electrochemical mediated reversible addition-fragmentation chain-transfer polymerization (eRAFT) methods**

Tasks of the trainee:

- 1) Literature review on:
  - Reversible deactivation radical polymerization (RDRP) methods with a particular focus on reversible addition-fragmentation chain transfer polymerization (RAFT) methods,
  - Electrochemical mediated polymerization methods with special emphasis on electrochemical mediated reversible addition-fragmentation chain transfer polymerization (eRAFT) method,
  - Basics of electrochemical measurements (e.g. cyclic voltammetry) and electrolysis processes conducting,
  - Influence of different parameters, including electrochemical specifications, on the polymerization process and fundamentals of well-defined polymer architectures,
  - Examples of synthesis of polymers by eRAFT method (3 weeks).
- 2) Cyclic voltammetry measurements and electrolysis in practice (1 weeks).
- 3) Synthesis of polymers by eRAFT method (3 weeks).
- 4) Determination of the influence of different parameters on the polymerization process (3 weeks).
- 5) Critical evaluation of the results achieved by comparing them with others available in literature (1 week).
- 6) Report production (1 week).

**Traineeship in digital skills:** Yes  No

**Knowledge, skills and competences to be acquired by the end of the traineeship (expected Learning Outcomes):**

Know how and in what conditions electrochemical mediated reversible addition-fragmentation chain-transfer polymerization can be conducted.

- Know the methods to be applied in the evaluation of the polymerization progress.
- Know how to conduct cyclic voltammetry measurements, electrolysis processes as well as electrochemical mediated reversible addition-fragmentation chain-transfer polymerizations.
- Know how to determine basic parameters describing well-defined macromolecules.
- Understand RAFT and eRAFT mechanistic aspects and fundamentals of well-defined polymer architectures.

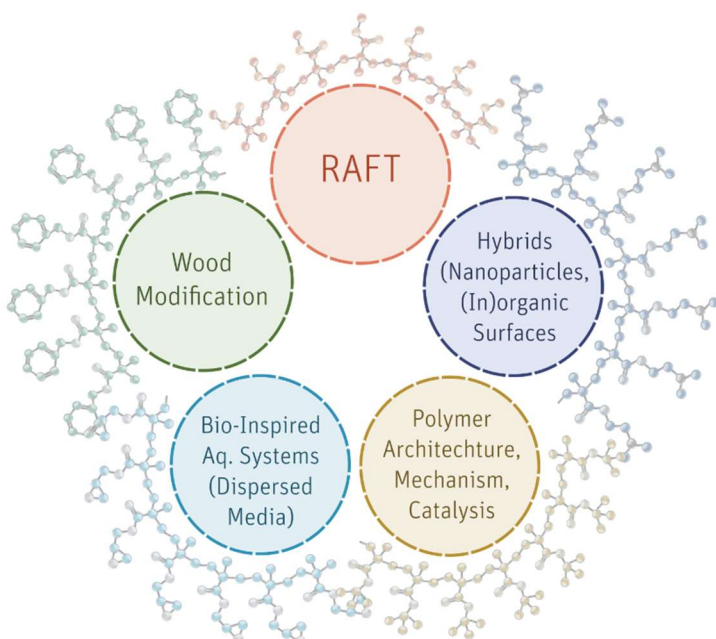
**Monitoring plan:**

The exchange of information about the progress of the placement between sending and host organizations. The student is obliged to inform sending institution about the advancement. Monitoring visit of the people involved in organizing and supervising the mobility (if, necessary). Submitting a report about the course of the placement.

**Evaluation plan:**

For evaluation of the training the following criteria will be taken into account: academic knowledge, analytical skills, foreign language skills, adaptability, communication, teamwork, initiative, decision-making.

The level of **language competence** in \_\_\_\_\_ [indicate here the main language of work] that the trainee already has or agrees to acquire by the start of the mobility period is: A1  A2  B1  B2  C1  C2  Native speaker



**Table A - Traineeship Programme at the Receiving Organisation/Enterprise**

Planned period of the mobility: from xx/xx/xx to xx/xx/xx

**Traineeship title: The use of naturally-derived substances as photocatalysts in Atom Transfer Radical Polymerization (ATRP)**

**Number of working hours per week: 30 Hours**

**Detailed programme of the traineeship:**

**Synthesis of well-defined polymer architectures by photoinduced ATRP**

Tasks of the trainee:

- 1) Literature review on:
  - Photoinduced Atom Transfer Radical Polymerization,
  - Influence of different parameters on the polymerization,
  - Fundamentals of well-defined polymer architectures and photocatalyst examined so far (2 weeks).
- 2) Synthesis of well-defined polymeric materials by photoinduced atom transfer radical polymerization (4 weeks).
- 3) Determination of the influence of different parameters on the polymerization process (4 weeks).
- 4) Critical evaluation of the results achieved by comparing them with others available in literature (1 week).
- 5) Report production (1 week).

**Traineeship in digital skills:** Yes  No

**Knowledge, skills, and competences to be acquired by the end of the traineeship (expected Learning Outcomes):**

- Know how to conduct photoinduced atom transfer radical polymerization.
- Know the methods that should be applied in the optimization of the polymerization processes.
- Know how to determine basic parameters describing well-defined macromolecules.
- Understand ATRP mechanistic aspects and fundamentals of well-defined polymer architectures.

**Monitoring plan:**

The exchange of information about the progress of the placement between sending and host organizations. The student is obliged to inform sending institution about the advancement. Monitoring visit of the people involved in organizing and supervising the mobility (if, necessary). Submitting a report about the course of the placement.

**Evaluation plan:**

For evaluation of the training the following criteria will be taken into account: academic knowledge, analytical skills, foreign language skills, adaptability, communication, teamwork, initiative, decision-making.

The level of **language competence** in \_\_\_\_\_ [indicate here the main language of work] that the trainee already has or agrees to acquire by the start of the mobility period is: A1  A2  B1  B2  C1  C2  Native speaker

