# Project meeting, Crete

E. Van Ruymbeke

21 September 2018

# 8 partners + 2 associated partners

- UNIVERSITE CATHOLIQUE DE LOUVAIN (UCL), BE
- FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS (FORTH), GR
- DSM AHEAD BV (DSM Ahead), NL
- UNIVERSITA DEGLI STUDI DI NAPOLI FEDERICO II. (UNINA), IT
- DANMARKS TEKNISKE UNIVERSITET (DTU), DK
- JOHANNES GUTENBERG-UNIVERSITAT MAINZ (JGU), DE
- ECOLE SUPERIEURE DE PHYSIQUE ET DECHIMIE INDUSTRIELLES DE LA VILLE DE PARIS (ESPCI), FR
- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (CNRS), FR
- *TESA, DE*
- *Allnex, BE*

*Blue: Involved in the previous ITN ‘Supolen’*

# 13 ESRs (Early Stage Researchers)

| ESR | Recruiting Participant | Joint supervision | Real staring Month |
|---|---|---|---|
| ESR1 Clément Coutouly | C.A. Fustin (UCL) | D. Vlassopoulos (FORTH) | Mars 2018 |
| ESR2 Rowanne Lyons | C.A. Fustin (UCL) | Q. Huang, O. Hassager (DTU) | September2018 |
| ESR3 Larissa Hammer | R. Nicolaÿ (ESPCI) | E. van Ruymbeke (UCL) | June 2018 |
| ESR4 Stefania Traettino | M. Cloitre (ESPCI) | S. Seiffert (UM) | September2018 |
| ESR5 Christina Pyromali | D. Vlassopoulos (FORTH) | S. Seiffert (UM) | April 2018 |
| ESR6 Wendi Wang | Q. Huang (DTU) | G. Ianniruberto (UN) | June 2018 |
| ESR7 Carole-Ann Charles | C. Ligoure (CNRS) | D. Vlassopoulos (FORTH) | January 2018 |
| ESR8 Consiglia Carillo | D. Vlassopoulos (FORTH) | C. Creton (ESPCI) | September2018 |
| ESR9 Simone Sbrescia | P. Steeman (DSM) | E. van Ruymbeke (UCL) | May 2018 |
| ESR10 Paola Nicolella | S. Seiffert (UM) | C. Fustin (UCL) | September2018 |
| ESR11 Hongwei Liu | G. Ianniruberto (UN) | O. Hassager (DTU) | September2018 |
| ESR12 Yanzhao Li | E. van Ruymbeke (UCL) | S. Seiffert | September2018 |
| ESR13 Jianzhu Ju | C. Creton (ESPCI) | C. Ligoure (CNRS) | September2018 |

# 9 visiting experts:

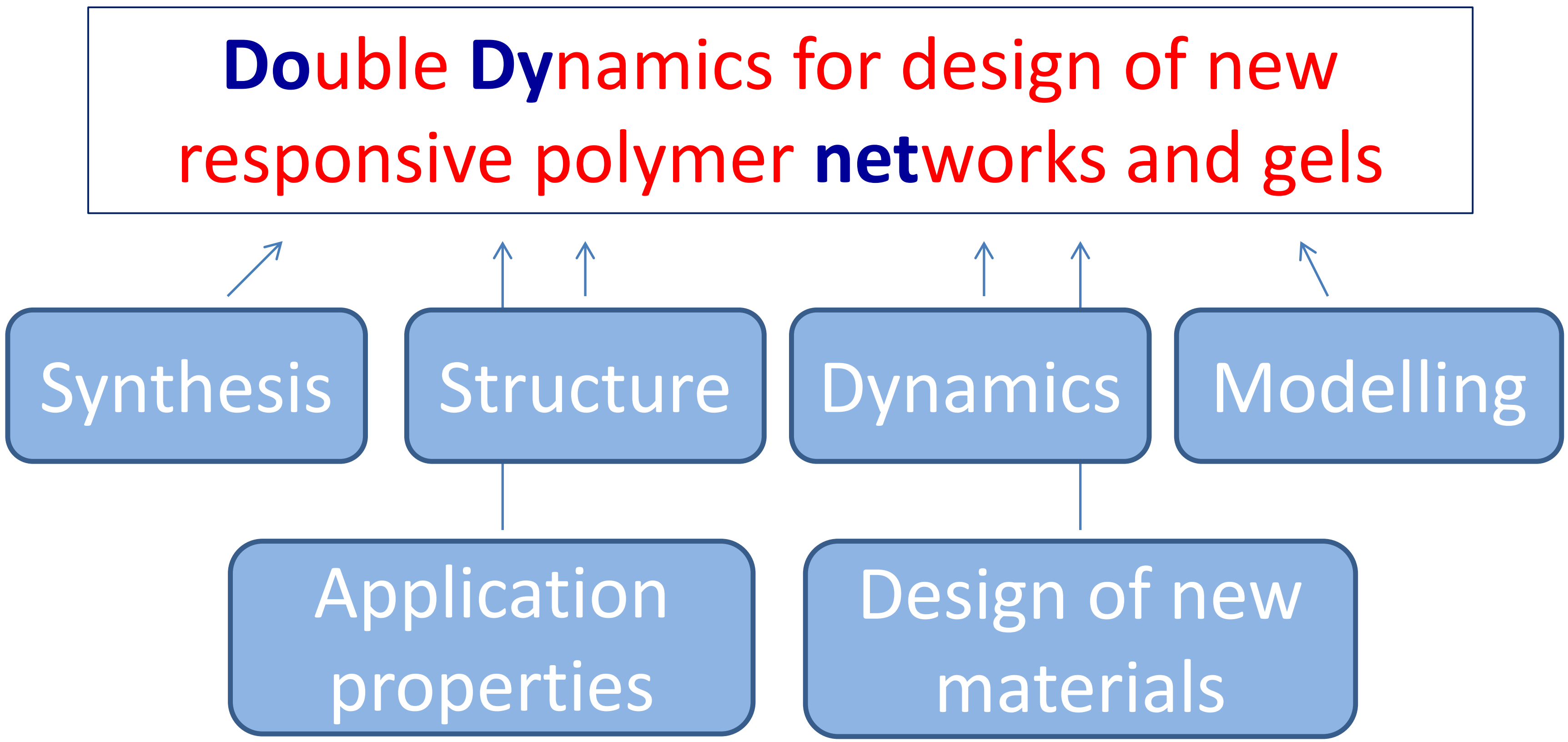
**Visiting experts and topics of lectures**

| VISITING EXPERT | AFFILIATION | KEY EXPERTISE AND TOPIC OF LECTURE |
|---|---|---|
| **Michael Rubinstein** | University of North Carolina, Chapel Hill, USA | 1) Polymer physics<br>2) Random branching and gelation |
| **Ralph H. Colby** | Pennsylvania State University, USA | 1) Linear Viscoelastic Characterization<br>2) Reversible polymeric gels and association times probed by dielectrics |
| **Hiroshi Watanabe** | Kyoto University, Japan | Dynamics of associating polymers and dielectric properties |
| **Jian Ping Gong** | Hokkaido University, Japan | Synthesis and performance properties of Double Polymer Networks |
| **Emanuela Del Gado** | Georgetown University, USA | Statistical mechanics of reversible polymer networks and gels |
| **Ilja Voets** | Eindhoven University of Technology, NL | Rational design strategies for novel functional soft materials |
| **Zuowei Wang** | University of Reading, U.K. | Multi-scale computer simulation and theoretical modelling of soft matter |
| **Daniel Read** | University of Leeds, U.K. | Tube-based models for describing the dynamics of complex and associating macromolecules |
| **Bradley Olsen** | MIT, USA | Nanoscale structures and properties of bioinspired and functional polymers |

# and 1 project manager…

INITIAL TRAINING NETWORK

, working on the same objective

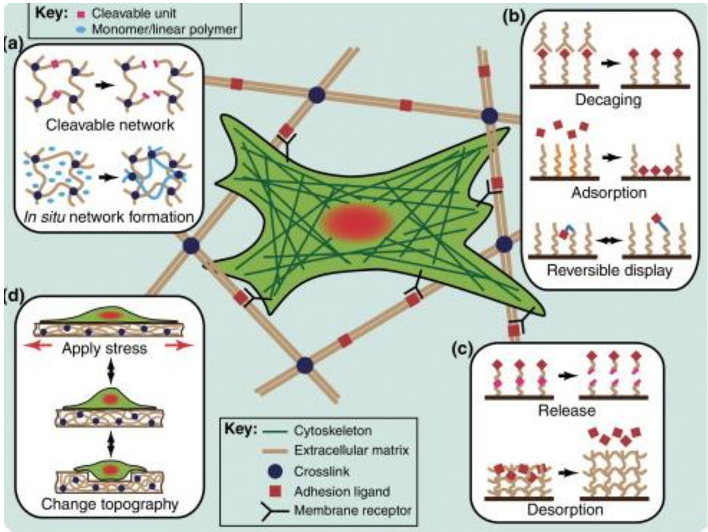


# Objective

## Polymer networks and gels are everywhere!

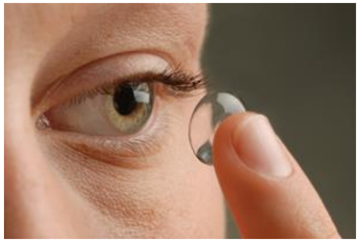
High performance rubbers


Battery electrolyte




Tunable media for cell culture

Superabsorbant polymers



Bio-implants


Scratch proof coating

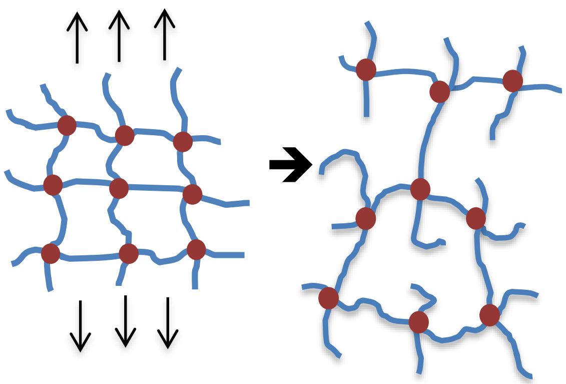
Vibration dampers

# Objective

**But the perfect polymer network does not exist**

**Chemical network**

Covalent bond



Crosslinking point

*Good mechanical strength*

*Low deformability*

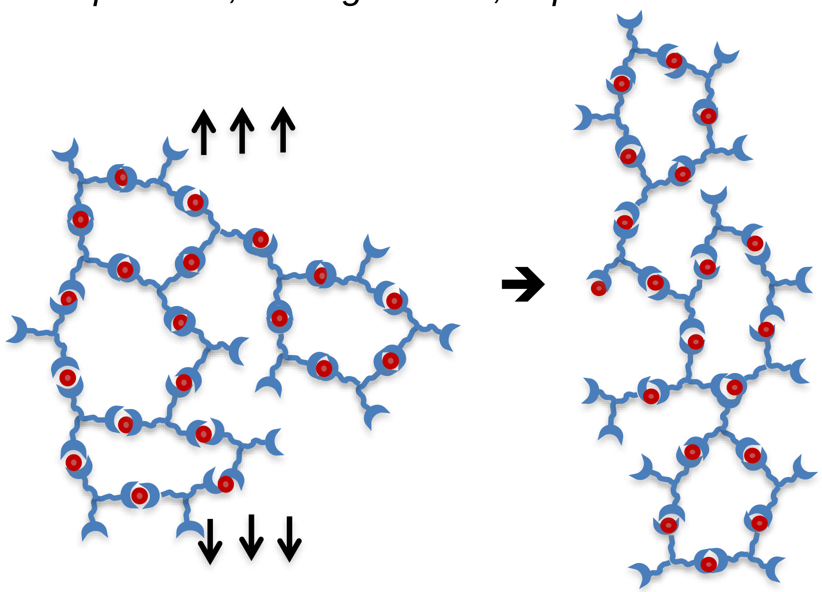
*Permanent damage*

*Low tunability*

**Physical network**

Non covalent bond

*Phase separation, entanglements, supramolecular bonds*



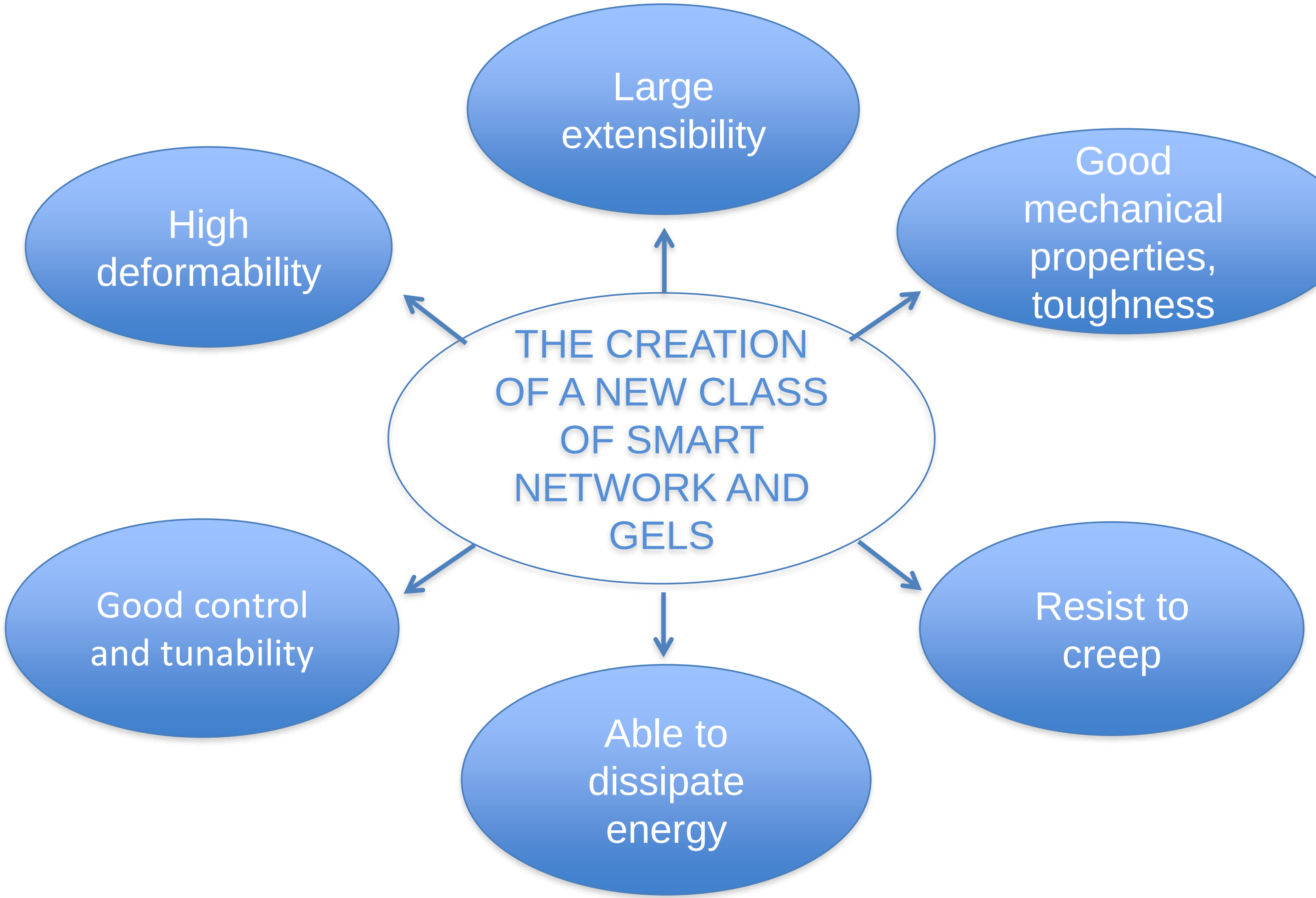
*Large Creep*

*Self-healing*

*Large tunability*

# Objective

## Present challenge



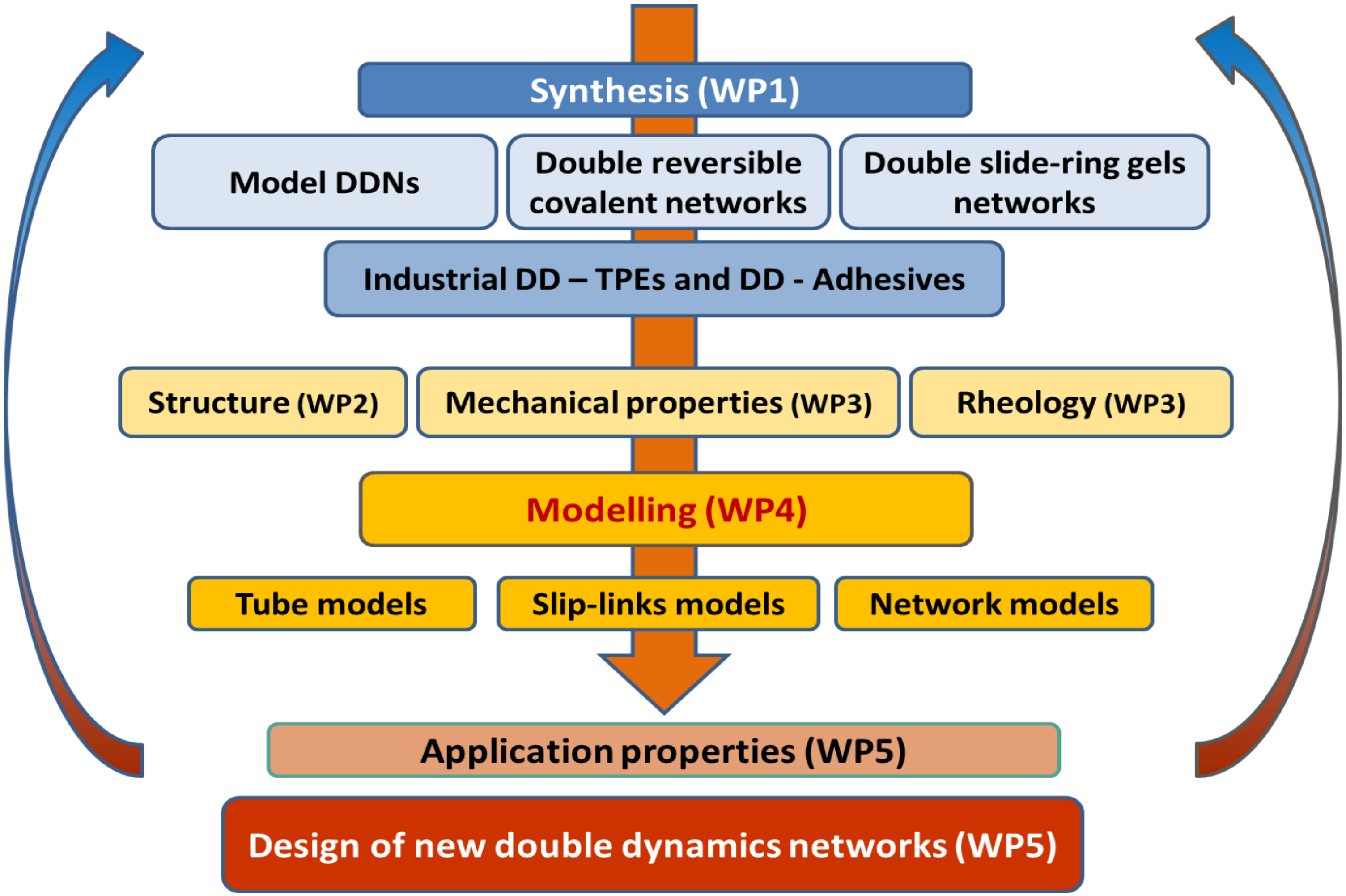
# Objective

**To combine and control within the same material all distinct features that make them ideal for applications, such as high mechanical strength, large reversible deformability in shear and extension, substantial reversible swelling, and self-healing properties**

**Combination of at least two distinct dynamic modes** within the same material in order to display multiscale viscoelastic responses

***Do****uble* ***Dy****namics for design of new responsive polymer* ***net****works and gels*

# DoDyNet

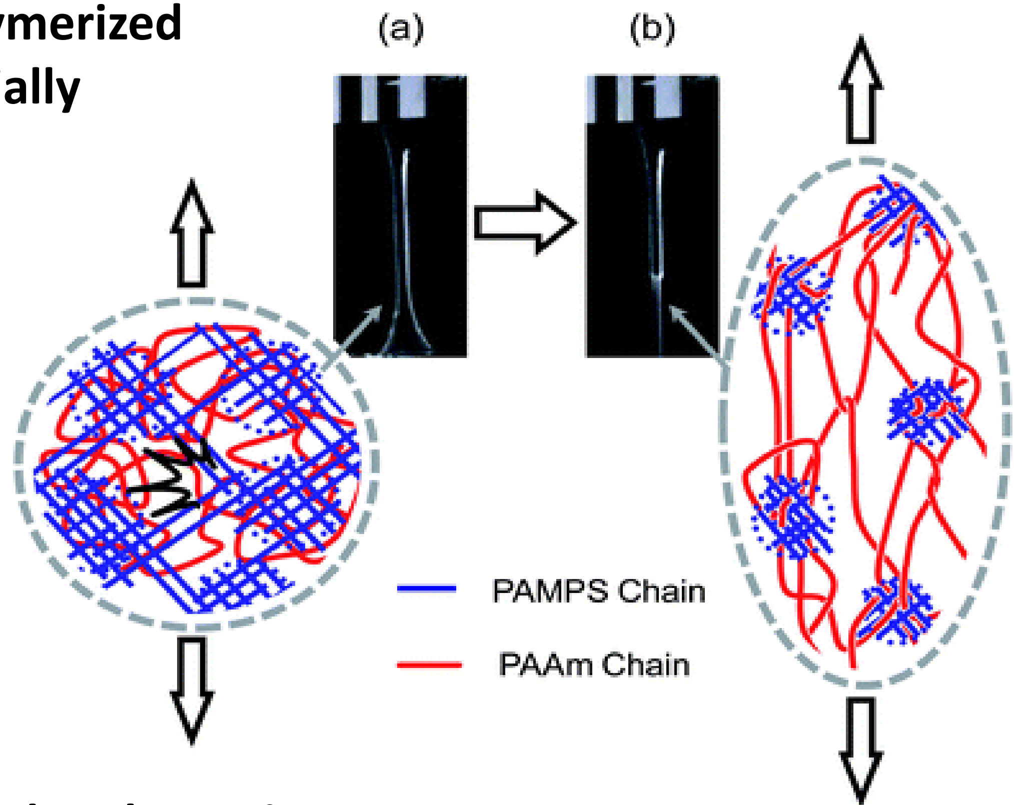



*With a deeper understanding of the relationships between these different areas*

# Interpenetrated polymer networks

*Gong and co-workers*

**Two interpenetrating networks polymerized and chemically crosslinked sequentially**




**The first network:**
Highly crosslinked and stretched, “sacrificial minority network”

**The second “majority” network:**
Large deformability (hence coherence of the overall structure)

**Permanently damaged under elongation**

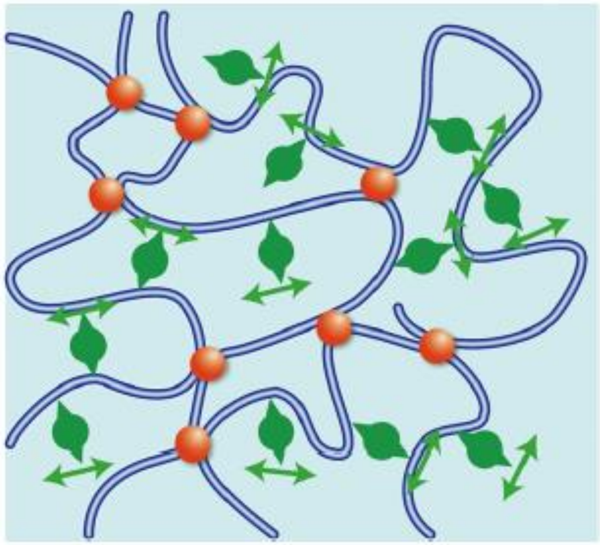
**Hybrid DNs: covalent bonds of the stiff network are replaced by reversible bonds**

*Viscoelastic properties has hardly been addressed*

# Dual Networks

*Creton, Narita, and co-workers*

**Single network combining two types of crosslinkers**



Slightly crosslinked chemically + additional supramolecular junctions

*These networks break **irreversibly***

A subclass of dual networks: Two different types of supramolecular crosslinks within the same material.

- Full self-healing, possible recycling and large tunability

- Poor resistance to flow and creep.

# Double Dynamics Networks (DDN):

- Easy to process and recycle
- Able to dissipate energy to resist fracture
- With large modulus
- In melt state or in solution
- Taking advantage of chain entanglements
- Taking advantage of the expertise of our chemists ☺

# Systems proposed

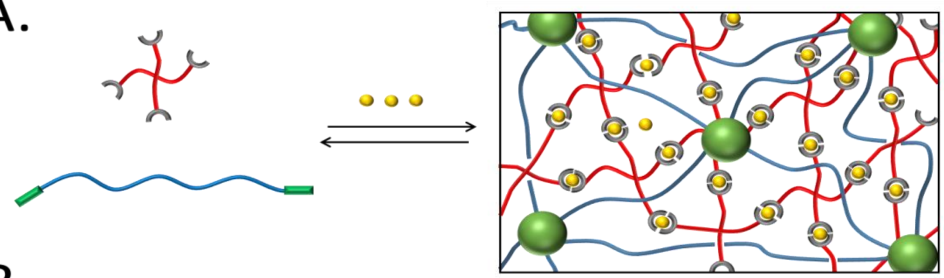
## System 1:

**Combination of <u>metal-ligand interactions, phase separation and entanglements</u>**

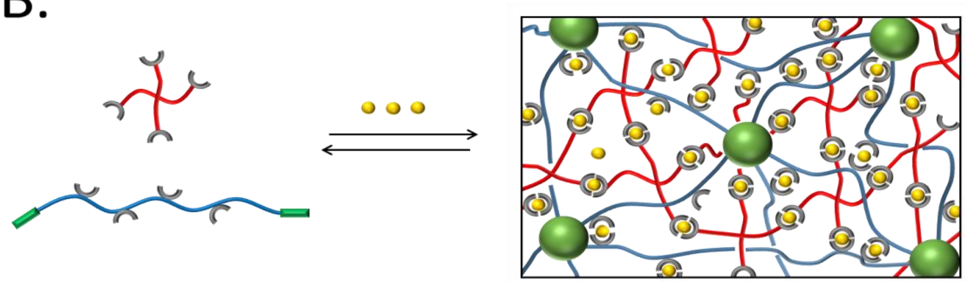
Metallo-supramolecular network
+
Long lifetime network based on the phase separation of ABA triblock copolymers

- Independent networks, or not
- Two different mesh sizes

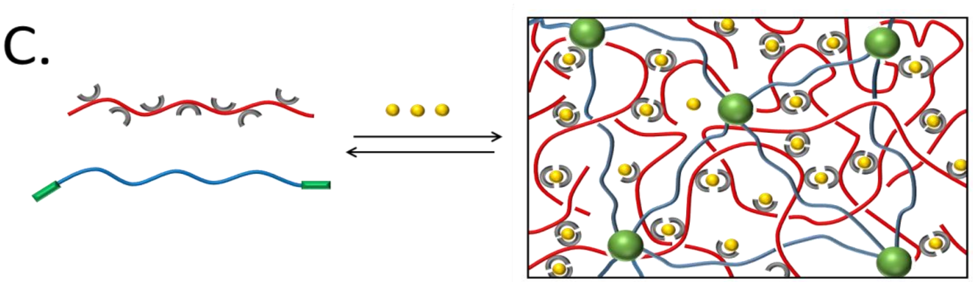
1.A.



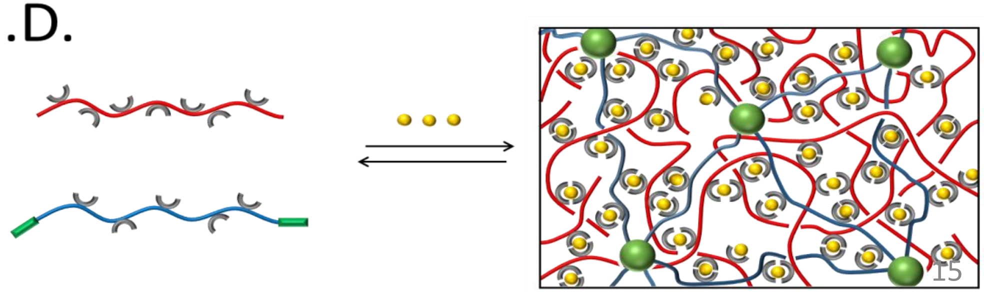
1.B.



1.C.



1.D.



# Systems proposed

## System 2:

**DDNs based on reversible covalent bonding**

*They are composed of double, interpenetrated, polymer networks containing reversible, and potentially dynamic, chemical crosslinks (e.g., thiol-disulfide[4] and Diels-Alder cycloaddition) that will be orthogonal.*

They are resistant to flow and creep, but they will be recyclable and healable under specific and different conditions

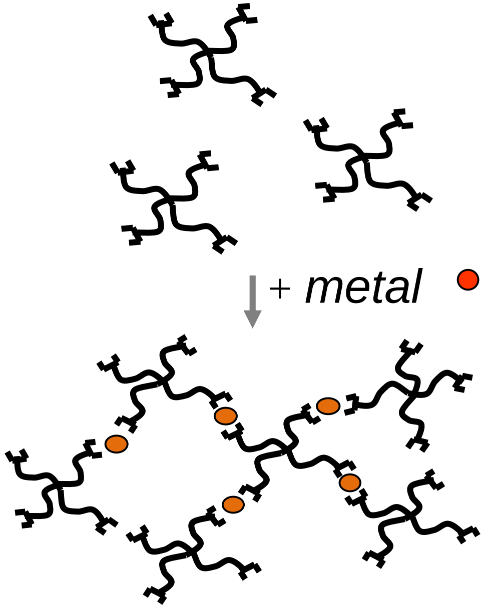
# Systems proposed

## System 3:

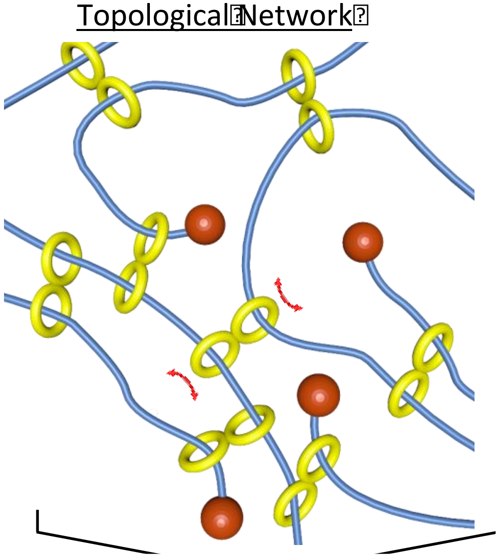
### Double Dynamics slide-ring gels

First network of telechelic star or long linear polymers crosslinked by metal-ligand bonds
+
A second network based on slide-ring movable crosslinks.

Not good healing properties by extreme resistance to large deformations




+

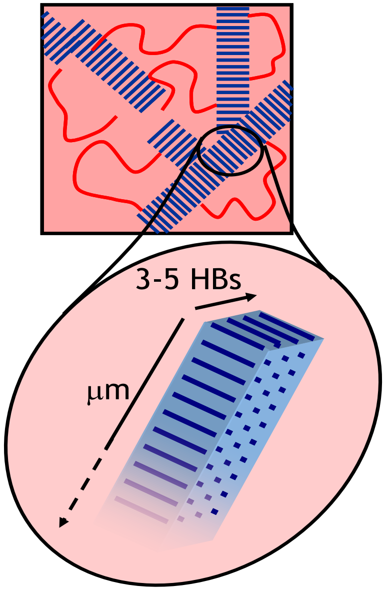


# Systems proposed

## System 4: Industrial samples with direct relevance in applications

**Double Dynamics Thermoplastic elastomers (DD-TPE)**

Blending different types of TPEs (with different HS density, chain length, HS length, segmented or tri-blocks, …) in order to tailor bonds lifetimes, connectivity, extensibility and chain mobility



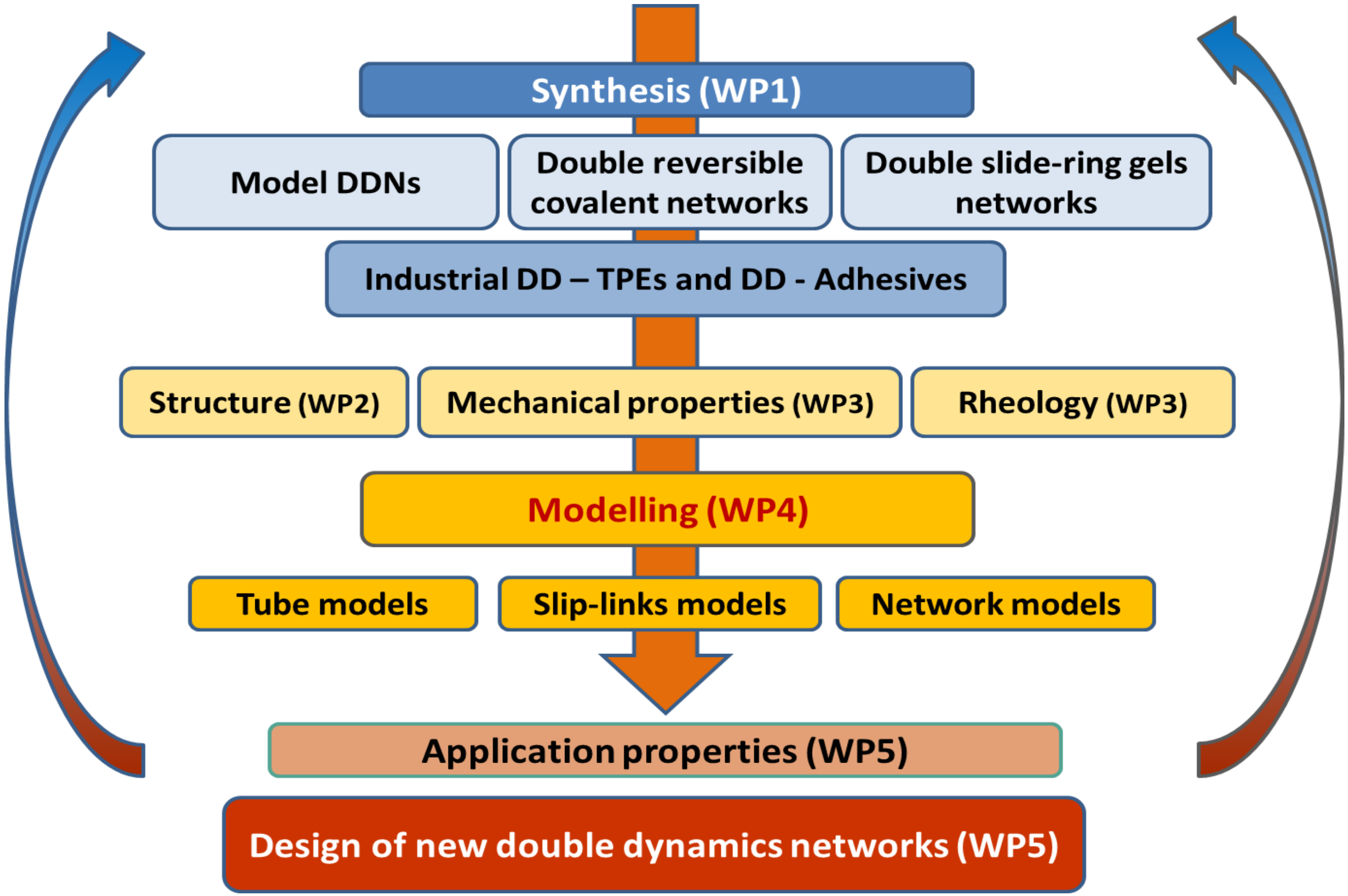

**Pressure sensitive adhesive (PSA) DDNs:**

- Combining crosslinkers of different nature in order to

  avoid creep
  ensure sufficient energy dissipation and low modulus

- Understanding and controlling the dynamics and adhesive properties of these PSA in order to optimize the performance of the tapes made with these adhesives

# Research Work Packages (WPs)




*With a deeper understanding of the relationships between these different areas*

# Research methodology

## WP1 - Synthesis and preparation of new DDNs

**WP leader: CA Fustin**

**Clement (ESR1)**
**Rowanne (ESR2)**
**Larissa (ESR3)**
**Stefani (ESR4)**

### Synthesis of model DDNs,

**Task 1.1.: Synthesis of telechelic star polymers**:

**Task 1.2.: (Functionalized) ABA triblock copolymers**

**Task 1.3.: Long linear functionalized polymers**

**Task 1.4.: Elaboration of DDN and role of their composition**

### Synthesis of DDNs based on reversible covalent chemistry :

**Task 1.5.: Design and synthesis of new reversible covalent networks for new properties**

### Synthesis of DDNs involving slide-ring gels

**Task 1.6.: Synthesis of slide-ring DDN**

**Task 1.7.: Optimizing the performances of slide-ring DDN**

### Creation of DDNs based on industrial building blocks:

**Task 1.8.:** Creation of DD thermoplastic elastomers

**Task 1.9.:** Creation and distribution of DDNs for pressure sensitive adhesives

| WP Number | 1 | M1 – M48 |
|---|---|---|
| WP Title | **Synthesis and preparation of new DDNs** | |
| Lead Beneficiary | C.A. Fustin (UCL) | |

**Objectives:** To synthesize different DDNs which will be used to develop a deep conceptual understanding of their dynamics and mechanical properties.

**Synthesis of model DDNs, (Category 1, systems 1.A to 1.D - see Section 1.1.3).**

**Task 1.1.: Synthesis of telechelic star polymers**:[7] star polymers end-functionalized with a terpyridine ligand will be obtained either starting from commercially available PEO stars that will be functionalized (for melts and solutions), or by RAFT using a multi-functional chain transfer agent (CTA) bearing terpyridines, which allows using a wide variety of monomers and functional groups. These two procedures have already been successively used by partner P1[12]. Poly(nbutyl acrylate) (PnBA) stars will be the starting choice for melt studies, but other polymers will also be prepared from the same functional CTA.

**Task 1.2.: (Functionalized) ABA triblock copolymers** will be obtained by RAFT.[1] A bifunctional CTA will be used to insure a polymer growth from both sides, for controlling the equal length of the outer A blocks, which will be of various nature and length to change their glass temperature $T_g$ and escape dynamics. The central B block will either be made of PnBA (for melts) or of poly(dimethylacrylamide) (PDMAA) (for solutions), with an appropriate comonomer bearing a terpyridine ligand for functionalized triblocks. Partner P1 is well experienced in the use of such monomers.[7] Some ABA triblocks are also commercially available.

**Task 1.3.: Long linear functionalized polymers** will be obtained by RAFT by copolymerizing the B monomer with a comonomer bearing a terpyridine ligand as for the functionalized ABA triblocks.[13]

**Task 1.4.: Elaboration of DDN and role of their composition:** Different DDN will be prepared by combining the building blocks in various ways (see 1.1.3). In general, DDN will be prepared by co-dissolving the precursors of the metal-ligand network (stars or linear polymers) and the ABA triblock in a selective solvent of the B block. The phase separated network will thus form in the presence of the precursors of the metal-ligand network, insuring a better homogeneity. Swelling this network in a solution of metal cations will then induce the formation of the metal-ligand supramolecular network within the phase separated one.

**Synthesis of DDNs based on reversible covalent chemistry (category 2, systems 2.A – see Section 1.1.3):**

**Task 1.5.: Design and synthesis of new reversible covalent networks for new properties**:[4,8,9] The two chosen reversible chemistries are the thiol-disulfide coupling and the Diels-Alder reaction between furan and maleimide derivatives, since they can be selectively and reversibly dissociated (by oxido-reduction and thermal treatment, respectively) and are stable in aqueous media (for hydrogels). The first dense network will be prepared by radical copolymerization of DDMA with a bisacrylamide crosslinker containing a disulfide bond. The DDN will then be obtained by radical copolymerization, within the swollen first network, of DDMA with a bisacrylamide crosslinker containing a Diels-Alder cycloadduct. Partner 3 has the needed competences to prepare such samples. The crosslinking density, functionality and molecular weight of the constituting chains will be easily tuned. Also, it is possible to vary the structure of the disulfide moiety and of the Diels-Alder adduct in order to obtain a large variety of dynamics and mechanical properties (both hydrogel and elastomer) and adjusted to specific behaviors.[8]

**Synthesis of DDNs involving slide-ring gels (category 2, systems 2.B – see Section 1.1.3):**

**Task 1.6.: Synthesis of slide-ring DDN:**[5] These systems will be composed of a first network of telechelic polymers crosslinked by metal-ligand bonds, and of a second network based on slide-ring crosslinks, following the chemistry developed by Ito (based on free radical polymerization and polyrotaxanes made of functionalized cyclodextrins threaded onto a PEO chain as crosslinker). The DDN will be prepared by a one-pot approach. Typical monomers will be of the acrylamide family with a charged co-monomer for better performance. The polyrotaxane crosslinker is commercially available or can be made using classical cyclodextrin chemistry.

**Task 1.7.: Optimizing the performances of slide-ring DDN**: Amount of metal-ligand precursors (star or linear polymer), length of the precursors, lifetime of the metal-ligand, amount of polyrotaxane crosslinker, preparation conditions and protocol will be important parameters to tune and optimize the performances of the obtained DDN.

**Creation of DDNs based on industrial building blocks (category 3 – see Section 1.1.3):**

**Task 1.8.:** Creation of DD thermoplastic elastomers
**Task 1.9.:** Creation and distribution of DDNs for pressure sensitive adhesives

Description of Deliverables, directly related to Tasks 1: see Table 3.1b.

# Research methodology

## WP2 : Structure and quiescent dynamics

**WP leader: S. Seiffert**

**Christina (ESR5)**
**Paola (ESR10)**

Objective:

*To quantitatively characterize the nano- to microstructural complexity of DDNs (due to supramolecular crosslinks or nanophase separation) by the mutually synergistic use of **scattering and fluorescence-microscopy techniques**.*

**Task 2.1.: Dynamic light scattering (DLS)**

**Task 2.2.: Microscopy-based techniques of fluorescence recovery after photobleaching (FRAP) and fluorescence correlation spectroscopy (FCS):**

**Task 2.3.: Small-angle X-ray (SAXS) and neutron scattering (SANS)**

# Research methodology

## WP3: Viscoelasticity, nonlinear rheology and mechanical properties

WP leader:
D. Vlassopoulos

Christina (ESR5)
Wendi (ESR6)
Carole-Ann (ESR7)
Consiglia (ESR8)

Objectives:

*Understanding and decoding the **exact role of molecular parameters of DDNs** such as entanglements, dangling ends or chain architecture on the dynamics of DDNs. Special emphasis will be put on **bridging rheological and mechanical properties into an emerging general picture**.*

**Task 3.1.:** Diagnostic tests involving **linear viscoelastic measurements (LVE)**

**Task 3.2.: Step shear measurements**

**Task 3.3.: Nonlinear creep tests**

**Task 3.4.: Transient elongation**

**Task 3.5.: Cyclic mechanical compression and tensile tests**

**Task 3.6.: Elasto-capillary effects (for ultrasoft materials)**

# Research methodology

## WP4: Atomistic and mesoscopic modelling towards DDN design guidelines

WP leader:
E. Van Ruymbeke

Hongwei (ESR11)
Yanzhao (ESR12)

Objectives:

*The knowledge acquired from WP2, WP3 and WP5 will be implemented into two different models, at the mesoscopic and at the atomistic levels. Both will be used in order to explore and design new systems with enhanced properties.*

**Task 4.1.: Tube models for describing the linear viscoelasticity** (LVE) **of telechelic DDNs**

**Task 4.2.: Statistical models to describe the location and number of cross-linking points**

**Task 4.3.: Tube models in order to describe the LVE of DDNs based on sticky building blocks**

**Task 4.4.: Modelling the nonlinear viscoelastic response of DDNs**

**Task 4.5.: Modelling the LVE of slide-ring networks**

# Research methodology

## WP5: Design and properties of responsive DDNs for new applications

WP leader:
C. Creton

Simone (ESR9)
Jianzhu (ESR13)
All

Objectives:

*To **link molecular, macromolecular, and supra-macromolecular structure of DDNs with application properties.** Main tasks will be to identify target industrial applications and relevant properties, to choose the appropriate DDN and synthesis scheme and to test and validate the above ideas.*

**Task 5.1. Adhesive properties** (advanced probe tack tests)

**Task 5.2. Fracture mechanisms of DDNs** (rheo-optical technique)

**Task 5.3.: Physical ageing and slow dynamics in applications**

**Task 5.4. Tribology of DDNs**

**Task 5.5. Self-healing properties**

**Task 5.6. Target applications**

# Target applications

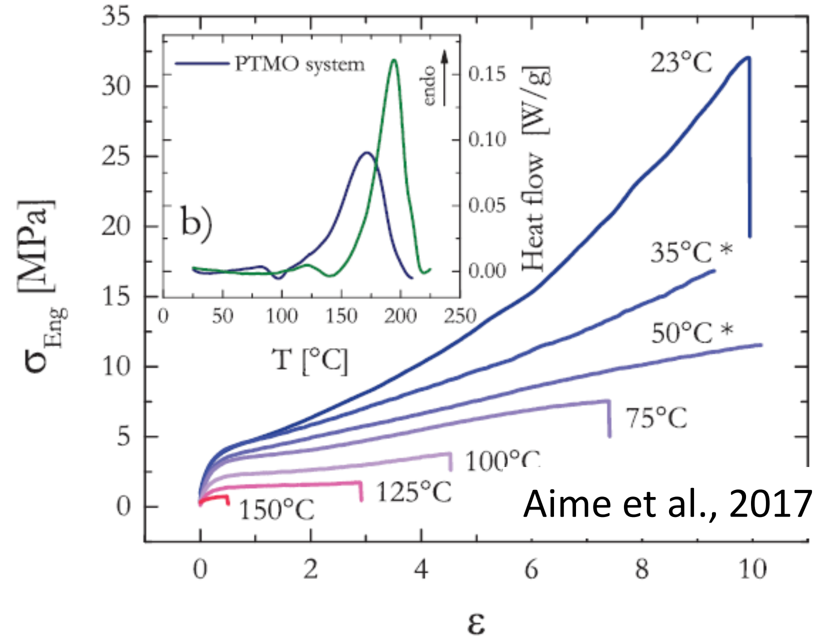
## DD Thermoplastic elastomers:

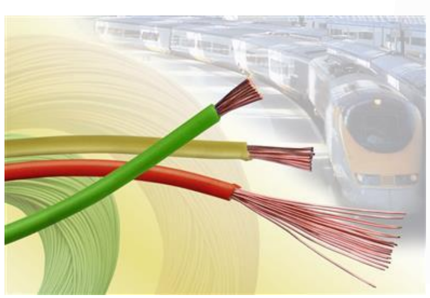
*For construction, cables, packaging, …*

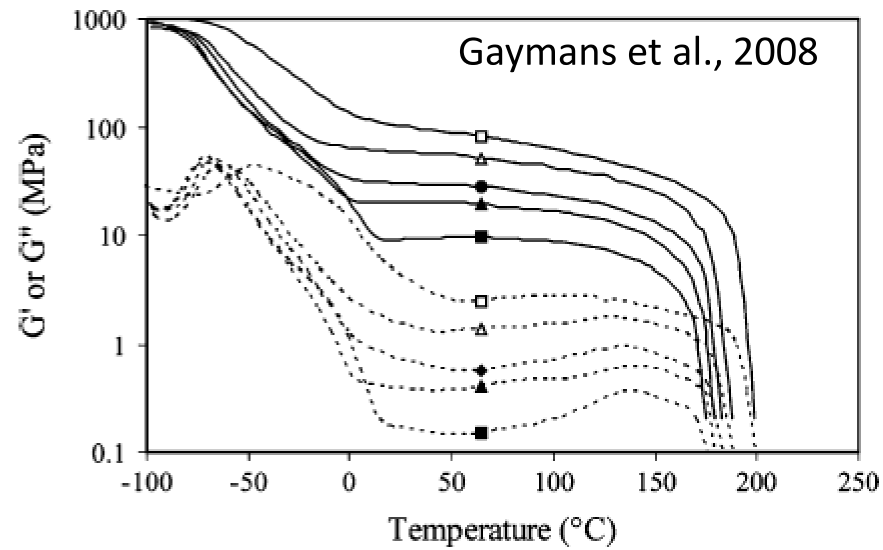
**Objective:**

TPEs with better drawability and mechanical properties at high temperatures

sharp glass and melting transitions and a nearly temperature-independent rubbery plateau modulus





# Target applications

## *DDNs in coatings applications*

- use of reversible networks in **coatings technologies** to reduce the stress resulting from differential thermal contraction between coating and substrate

- tailoring the resistance of coatings and **their adhesion at interfaces,** with applications in aircraft, automotive or architectural sectors

Development of **easily removable coatings**

Development of **haptic materials** (such as soft-feel or soft-touch coatings), which are presently gaining widespread use

# Target applications

*DDN as a new class of pressure sensitive adhesives (PSAs):*

DDNs are already applied in PSA technologies

➡ **optimization of their performance**

- To design new PSAs able to **withstand considerable shear load under changing temperature**

- To show large **resistance against high and low speed loading**

- To show **little variance in properties within a wide temperature range**

- Tapes able to show self-healing in specific conditions are of great interest

# Research methodology

| BENEFICIARY | SYNTHESIS And Molecular characterization | STRUCTURE | RHEOLOGY, MECHANICS | MODELLING | APPLICATION PROPERTIES |
|---|---|---|---|---|---|
| UCL | Reversible networks based on metal-ligand bonding, slide-ring gels | | Linear rheology, Dynamic mechanical analysis | Molecular modelling of rheology | |
| FORTH | | DLS,access to SANS and rheo-SANS, DSC | Nonlinear Shear, and extensional rheology; piezo-rheometry; rheo-optics | | |
| ESPCI | Reversible covalent chemistry | Access to SANS, rheo-SANS, microscopy | Linear viscoelasticity Nonlinear rheology, rheo-physics | | Tack adhesion, self-adhesion, fracture |
| UN | | | | Multi-scale modeling | |
| UM | | Scattering and diffusion techniques | | | |
| CNRS | | SAXS, DLS, access to SANS | Elasto-capillarity | | Healing, slow dynamics, tribology |
| DTU | | | Filament stretching rheometry, Extensional rheology | | |
| DSM | Supramolecular thermoplastic elastomers | | Tensile and compression tests | | |
| tesa | In house polymerization of polyacrylate PSA | | Mechanical characterization | | Industrial tests for adhesive properties |
| Allnex | Synthesis and formulations | IR, NMR | Mechanical characterization | | Coating and application technology |

# PhD projects and co-supervision

# Early Stage Researchers (ESRs)

Main targets are defined in the proposal:

| | Host | PhD | Start | Duration | Scientific Deliverables |
|---|---|---|---|---|---|
| **ESR8** | **FORTH** | **Y** | **9** | **36** | **D3.8a, D3.8b, D5.8a, D5.8b**<br>*Awarding of PhD degrees: M45* |

**Deformability and fracture mechanisms in reversible covalent DDNs** (Related WPs: **WP3**, WP5)

**Objectives:**
- Study in depth the nonlinear shear behavior of the new DD systems 2, as a function of their composition. – see Task 3.2. (FORTH)
- Investigate the origin of fracture mechanisms and self-healing properties of these networks - see Tasks 3.2, 3.3 and 3.5. (FORTH)
- Study the loss of macroscopic cohesion of the DDNs by nonlinear creep tests – see Task 3.3. (FORTH)
- With ESR6, relate this nonlinear shear behavior to the transient elongation properties (DTU - FORTH).
- With ESR 13, relate shear behavior to fracture mechanisms – see Task 5.2. (FORTH – ESPCI)
- Design new reversible covalent DDNs for enhanced properties (All)

**Expected Results:** see Deliverables, **Novelty:** Establish the relationship between network structure, chain mobility and fracture process

**Planned secondment(s):**
- ESPCI – C. Creton (M28-M30): compare fracture mechanisms in shear and in tensile tests, and connect to adhesive properties.
Industrial secondment: tesa (M36-M37) – Relate shear behavior to adhesive properties

*Any change compared to the initial plan should be mentioned to the executive board (or project coordinator)*

# Early Stage Researchers (ESRs)

***Joint supervision of the ESRs and "minor project"*:**

All individual projects will involve collaboration between at least two partners, and will involve a second advisor: in addition to their main research topic, the ESRs will have to develop skills in another area, through long visits to this second advisor (<u>from 2 to 6 months</u>).

In addition to the PhD project, each ESR will have to:

- Perform a long (academic) visit to the second adviser
- Perform an industrial secondment
- Write 4 (5) reports during the whole project
- Publish at least 2 papers
- Participate to the training activities of the network

# Industrial secondment

| ESR | Recruiting Participant | Inter-sectorial stage | Period | Tentative Title |
|---|---|---|---|---|
| ESR1 | C.A. Fustin (UCL) | Allnex | M34-M35 | Reversible DDNs for coating applications |
| ESR2 | C.A. Fustin (UCL) | Allnex | M34-M35 | DD slide-ring gels for haptic coating application |
| ESR3 | R. Nicolay (ESPCI) | DSM | M40-M41 | Mechanical behavior of reversible covalent DDN and their potential for new applications |
| ESR4 | M. Cloitre (ESPCI) | DSM | M38-M39 | ageing and slow dynamics of DD TPEs |
| ESR5 | D. Vlassopoulos (FORTH) | tesa | M35-M36 | Relate creep behavior to adhesive properties |
| ESR6 | Q. Huang (DTU) | tesa | M40-M42 | Relating elongation behavior to adhesive properties |
| ESR7 | C. Ligoure (CNRS) | DSM | M30-M33 | Modelling percolation processes in DD-TPEs |
| ESR8 | D. Vlassopoulos (FORTH) | tesa | M36-M37 | Relate shear behavior to adhesive properties |
| ESR9 | P. Steeman (DSM) | UCL | 6 Months | |
| ESR10 | S. Seiffert (UM) | Allnex | M40-M42 | Importance of structure and diffusion in coating applications. |
| ESR11 | G. Ianniruberto (UN) | tesa | M43-M44 | Understand the role of chain stretching and strain hardening on the resistance of the DDNs. |
| ESR12 | E. van Ruymbeke (UCL) | Allnex | M37-M39 | Apply statistical tool on randomly crosslinked DDNs used in coating applications |
| ESR13 | C. Creton (ESPCI) | DSM | M20-M23 | Fracture mechanisms in DD-TPEs |

# PCDP: Personal career development plan

- Clearly defined research project
- Interdisciplinarity : joint supervision by senior scientists from different groups
- Define their work plan: structured courses and advanced modules + course on transferable skills
- Creativity and initiative < 2 pages proposal on work to do in the next 6 months

→ Annual update of PCDP approved by advisor and executive board

# Conformity form and Contract

- There is a conformity form to complete on the participant portal

- We would like to receive a copy of the contracts

# Meetings and training activities

# Training: at the local level

**Proposed list of transferable skills at the local level**

| BASIC TRANSFERABLE SKILLS | ADVANCED/SPECIALIZED SKILLS |
| --- | --- |
| Presentation skills | Knowledge management |
| Safety in work environment | Communication and media training |
| Introduction to research methodologies | Communication |
| English for non-native scientists (full semester) | Paper / proposal writing |
| Local language for non-native scientists (full semester) | Technical presentations (oral, poster) |
| IT courses (MS-office, SAP, Maple, programming) | Intellectual property (IP) rights |

# Network-wide training

- Elementary module (next week)
- Advanced modules

| EXAMPLE OF ADVANCED MODULES | RESPONSIBLE PARTICIPANT |
|---|---|
| Synthetic schemes for functional polymers (2 days + lab tour) | UCL, ESPCI (Fustin, Gohy, Nicolay) |
| Advanced rheology: shear (2 days including lab tour) | FORTH, UCL (Vlassopoulos, Bailly) |
| Advanced Rheology: extension (2 days including lab tour) | UCL, DTU, UN (van Ruymbeke, Huang, Ianniruberto) |
| Advanced Scattering techniques (2 days including lab tour) | FORTH, CNRS, UM (Loppinet, Cipelletti, Seiffert) |
| Structural and mechanical properties of complex fluids and transient networks (2 days including lab tour) | CNRS, DTU (Ramos, Ligoure, Hassager) |
| Atomistic and Mesoscopic Simulation of Complex Fluids (2 days) | DTU, UCL (van Ruymbeke, Ianniruberto) |
| Fracture and adhesion mechanisms in reversible polymer networks | ESPCI, tesa (Creton, B. Luehmann) |
| Responsive polymer networks in applications | DSM. Allnex, tesa (T. Engels, P. Roose, B. Luehmann) |

# Meetings

- Elementary/advanced module
- Project Meeting
- Two meetings per year

| | Main Training Events & Conferences | Training module (duration) | Project Meeting (duration) | Host Institution | Project Month |
|---|---|---|---|---|---|
| 1 | Kick-off meeting (Brussels)<br>Planning, recruitment, schedule of events | / | / | UCL | 1 |
| 2 | Intermediate Meeting I (Heraklion) | Elementary modules (3 days) | 2 days | FORTH | 9 |
| 3 | Annual Meeting I (Geleen) | Industrial workshop I (2 days) | 2 days | DSM | 13 |
| 4 | Intermediate Meeting II (Copenhagen) | Advanced Module I<br>Elementary module (3 days)<br>Transferable skill (1 day) | 2 days | DTU | 17 |
| 5 | Annual Meeting II (Naples) | Summer School (4 days) | 1 day (+ Midterm) | UN | 22 |
| 6 | Intermediate Meeting III (Montpellier) | Advanced Module II (2 days) | 2 days | CNRS | 30 |
| 7 | Annual Meeting III (Mainz) | Advanced Module III<br>(2 days) | 2 days | UM | 36 |
| 8 | Participation of each ESR in at least one international meeting<br>(Soft Matter Days, European Society of Rheology, APS, ACS, EPF, MACRO) | | / | | 20-45 |
| 9 | Intermediate Meeting IV (Hamburg) | Industrial workshop IV (2 days) | 2 days | tesa | 42 |
| 10 | Final International Meeting (Heraklion) | / | / | FORTH | 48 |

# Management

# Management

- Governing board
- Executive committee
- Advisory board
- Responsible fellow

# Management

**Governing board**

- Involves a member of each institution (one vote per institution)
- Will take the decisions and discuss all modifications of the initial plans
- Will meet annually (at least)
- Includes the training officer, the industrial officer, the dissemination officer and the gender officer

# Management

**Executive committee**

T. Engels (DSM)
D. Vlassopoulos (FORTH)
E. Van Ruymbeke (UCL)

- Will ensure that the project progresses according to the plans
- Will check the PCDP of the differents ESRs.
- Will propose to the governing board modifications of the training program if necessary

# Management

**Advisory board**

- Includes all the visiting experts
- Will comment on the progress of DoDyNet

**Responsible fellows**

- 2 of the ESRs
- Will be elected by the ESRs
- Will be responsible for the fellows activities
- Will participate in a part of the governing board

# Management

## Specific officers:

Training officer: Giovanni Ianniruberto

Industrial officer: Paul Steeman

Dissemination officer: Laurence Ramos

Gender officer: Qian Huang

## WP leaders

Charles-Andre Fustin, Sebastian Seiffert, Dimitris Vlassopoulos, Evelyne van Ruymbeke. Costantino Creton

## Project Manager

Christine Hambursin

Thank you!

*Tomorrow:*

*Reporting activities, Deliverables and Milestones, Website, Open Access Programme, Confidentiality rule, Agenda, Mid-term check, meeting organization, specific points for ESRs*