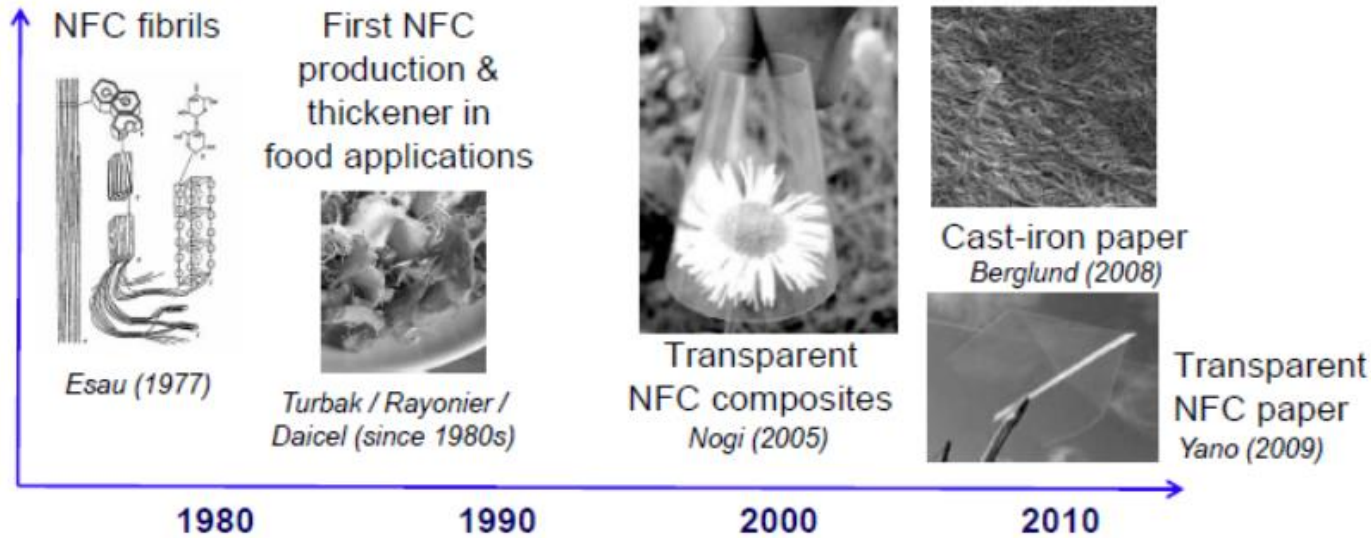


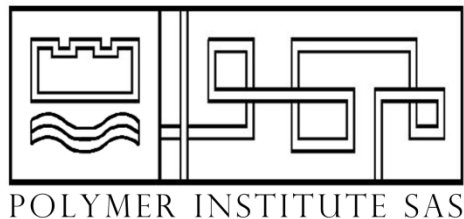
Ongoing R&D projects in COST member countries

September 2013





- Department of Composite materials
- Department of Biomaterials
- Department of Molecular simulations of polymer
- **Department of Synthesis and characterization of polymers**
 - Active group in COST Action 1205





The main topics of the Department of synthesis and characterization of polymers

- Studies of controlled/living polymerization techniques
- Synthesis of well defined functional polymers
- Synthesis of nanoparticles and hybrids
- Degradation and stabilization of polymers
- Photochemical studies in polymers
- Liquid chromatography research for effective separation of macromolecules
- Structure and physico – chemical properties of polymers

- *New Intention/Topic:* **Electrospinning of natural and synthetic polymers for applications such as medicine, agriculture, horticulture, cosmetic, filtration etc.**



Projects related to the COST Action 1205: 3

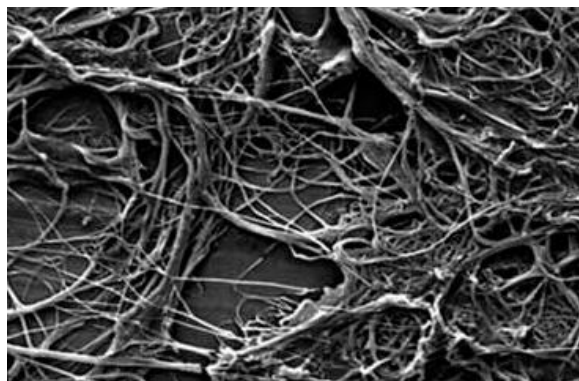
1.) Micro – and nanofibers from natural resources on the base of polysaccharides and peptides prepared by elektrospinning. (Duration of project: 1.1.2014-31.12.2015)

The project focuses on the preparation and modification of fiber webs formed by electrospinning from biopolymers. The electrospun webs are prepared from silk, cotton, cellulose and bovine tendons solutions. The surfaces of the webs are modified by bioactive molecules by means of chemical modification. The prepared materials are suitable materials for medical use.



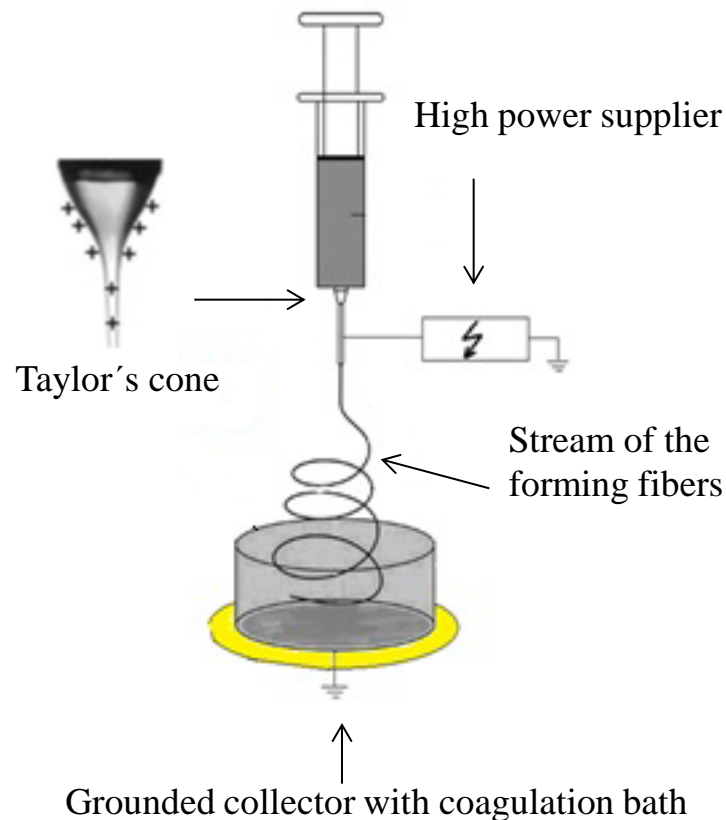
Electrospinning

- is an electrostatically driven method of fabricating polymer nanofibers.



Linda Haerdelin. *Electrospinning of cellulose nanofibres from ionic liquids*, Journal of Applied Polymer Science, Vol. 125, 1901–1909 (2012)

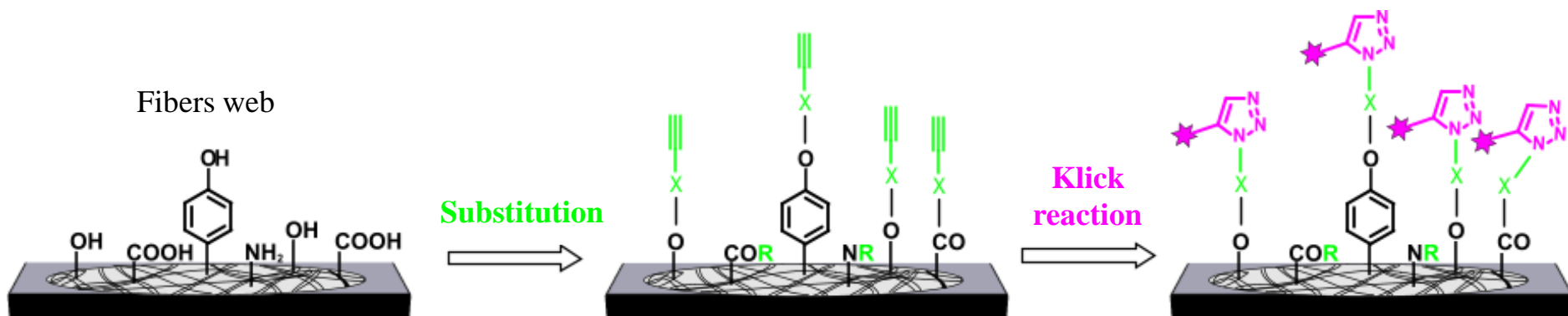
Container with charged polymer solution





Chemical modification

- heterogenous reaction
- functional groups on fibers are substituted by alkyne
- „klick“ reaction – Cu-catalyzed azide-*alkyne* cycloaddition
- 1,4-substituted triazols are enzymatic sú enzymatically cleavable





2.) Modification of fibers prepared by electrospinning on the base of polysaccharides. (Duration of project: 1.1.2014-31.12.2014)

Cellulose is suitable materials for medical use as well as for application in cosmetics, filtration, construction, agriculture and horticulture and composite materials. The aim of project is the preparation of films and electrospun webs from cellulose solutions, which contain the active component. The benefit of this work will be modification of cellulose fiber webs surface with antimicrobial active molecules by covalent bound for using mostly in medicine, agriculture or food industry.

This project is supported by Slovak Academy of Sciences



- COST FP1205: Innovative applications of regenerated wood cellulose fibres



3.) Targeted modification of films and electrospun webs of ultrafine fibers from biopolymers. (Duration of project: 1.1.2014-31.12.2015)

The preparation of films and electrospun webs from silk, cotton, cellulose and bovine tendons solutions, which contain the bioactive component, is studied. The mentioned materials are suitable for medical use as well as for application in optoelectronics, microelectronics, filtration, construction and composite materials.

In the frame of bilateral project: Polymer Institute of SAS, Slovakia and University of Tomas Bata in Zlin, Czech Republic

Fig. Cellulose films prepared from solution of ionic liquid 1-Butyl-3-methylimidazole acetate ([BMIM][Ac]) immersed into the coagulation bath 2/1 w/w acetone/water.



Specialist equipment



- HPLC/SEC instruments – UV detector (KNAUER), refractive index detectors (Knauer, ERC), evaporative light scattering detectors (Varian, Polymer Laboratories), fluorescence detector,
- Gas chromatography, FOCUS Gas
- Zetasizer Nano 2S – Dynamic light scattering
- UV-Vis spectroscopy, Shimadzu UV 1650 PC
- Fluorescence spectroscopy, Shimadzu RF 5301 PC
- Becker & Hechl TCSPC modular equipment
- Optical light detector – Ocean Optic QE65000
- FTIR spectroscopy, NICOLET 400
- Raman spectroscopy, iRaman Plus
- ESR spectroscopy, Varian
- Cone calorimeter
- Thermal stability and flammability LUMIPOL 3
- Differential scanning calorimetry
- Refrigerated centrifuge – Sigma 3-30K
- High power supplier, Spellman High Voltage Electronics, SL SERIES - electrospinning