Toward new sustanaible materials and processes

Research Seminar Lavoine's and Profili's Group (3h)
In this class both researchers will present their work. The first part of the presentation will focus on the use of cellulose to create advanced materials for different applications. The second part of the presentation will focus more on the use of plasma at atmospheric pressure to modify the surface of the materials. Here, plasma processes will be presented as a new method to modify the original proprieties of different substrates.

Overview on renewable nanomaterials and sustainable processes (3h)
During this theoretical class, an overview of sustainable materials and processes that are currently used in research will be presented. Particularly the student will discover the concept of green chemistry and renewable materials.

Practical class: synthesis of nanoparticles (3h)
In this class the students will discover the use of plasma for the synthesis of metallic nanoparticles. A brief presentation of the theory will support the experience. Then, different groups of people will be created and will focus on testing different ideas to modify the synthesis.

Sustainable packaging (3h)
In this theoretical class the student will discover the concept of packaging. The first part of the presentation an overview of the different approaches and work in the litterature to create a sustainable packaging with a conventional approach will be presented. During the second part of the presentation, the use of plasma technology to enlarge the possibilities of sustainable products in this field will be discussed. Here, the challenges and the opportunities offered by this technology will be analyzed in detail.

Practical class: deposition of thin films by plasma (9h)
In this class the students will discover the use of plasma for the synthesis of nanometric thin layers. A brief presentation of the theory will support the experience. Then, different groups of people will be created to realize the experiences. The practical class will be divided in three sessions:

- Part 1: Build your system. Here the student will be invited to think and build a small system to deliver the gases into the plasma.
- Part 2: Create your thin layer. Here the student will be invited to think about different strategies to deliver an organic molecule into the plasma. The first layers will be realized on a cellulosic material.
- Part 3: From the ideas of the students and the discussions built in the session, different plasma parameters will be tested to create different organic layers on paper.

Let's discuss sustainability (3h)
The first part of the presentation will focus on an overview of different new concepts related to sustainability (biomimicry, LCA, etc.). A group activity will be proposed to develop new ideas by using a design thinking approach. This brainstorming open session is proposed to highlight different opportunities and collaboration that will be possible to create in the future with the professors and students.

From laboratory to market (3h)
This session will highlight the existing gap between the laboratory and the industry. During the first part, we will present different examples of companies with sustainable products on the

market. We will focus on different examples of fails and successes to highlight the challenges related to the commercialization of a product. The concept of bcorporation will also be presented. During the second part of this session, we will focus on a critical analysis of the ideas presented during the previous class (Let's discuss sustainability).

Personal session with the students (student's projects) (8h)
These sessions will be dedicated to the students. Personal meetings will be organized to discuss the research projects.