UNIVERSIDADE FEDERAL DE SÃO CARLOS

PRÓ – REITORIA DE PÓS-GRADUAÇÃO

COURSE DESCRIPTION SHEET

1. Course Name: **Polymer Degradation**
2. Course Code: 207
3. Semester offered: 2nd
4. Total course credits: 2
5. Course workload

   5.1. Lecture classes: 15h

   5.2. Practical classes:15h

   5.3. Seminars: 45h
6. Course Syllabus:

   - Degradative environments (thermal, mechanical and photochemical initiation). Auto-catalytic degradation cycle. Biodegradation and oxo-biodegradables. Analytical techniques for monitoring polymer degradation (FTIR, thermal analysis, GPC, mechanical tests). Degradation of heterophasic systems. Case studies in Brazil and recurring problems in the industry. Topics of forensic expertise in the area of polymer degradation. Proposed class distribution:
   - (2 Classes) Introduction to aspects of polymer science relevant to the course
   - (2 Classes) Degradative environments

     .1. Thermal: Bond energy and influence of connectivity.

     .2. Mechanical: Shear and polymer processing environments, conformational bond stress.

     .3. Photochemical: laws of photochemistry, energy transfer.
   - (2 Classes) Initiation processes and auto-catalytic degradation cycle

     .1. Thermal

     .2. Mechanical

     .3. Photochemical

     .4. Case studies among the most used thermoplastics
   - (2 Classes) Biodegradation

     .1. Conditions for biodegradability

.2. Oxo-biodegradation (accelerated degradation to form biodegradable fragments)

- (4 Classes) Analytical techniques for monitoring degradation
  .1. FTIR: formation of polar groups during oxidative processes, carbonyl and hydroxyl indices, comparison between samples of different nature.
  .2. TGA: Determination of initial temperature of apparent degradation, temperature at which maximum mass loss rate occurs, and percentage of carbonaceous residues.
  .3. DSC: Variation of crystallinity as a function of chain size variation and/or formation of polar groups.
  .4. OIT: Use of DSC and/or TGA to determine oxygen induction time.
  .5. Mechanical tests: variation of mechanical properties as a function of degradation.
- (2 Classes) Heterophasic systems: degradation studies of blends and composites
- (1 Class) Forensic expertise in the area of polymer degradation
  .1. Mechanical
  .2. Photochemical
  .3. Case studies among the most used thermoplastics

7. Main Bibliography:

- Marco-Aurelio De Paoli. Degradação e estabilização de polímeros. Artliber, 2008 (disponível para download gratuito em http://www.chemkeys.com/blog/2008/09/03/degradacao-e-estabilizacao-de-polimeros)
- The role of physical structure and morphology in the photodegradation behaviour of polypropylene, Polymer Degradation and Stability, Vol. 56, n. 1, 55-73
- Poli(Tereftalato de Etileno), PET: Uma Revisão Sobre os Processos de Síntese, Mecanismos de Degradação e sua Reciclagem, Polímeros: Ciência e Tecnologia, vol. 19, nº 2, p. 121-132, 2009, Romão W, Spinacé MAS, De Paoli MA
- Evaluation and identification of degradative processes in post-consumer recycled high-density polyethylene, Polymer Degradation and Stability, Vol. 80, n. 1, 31-37
- Ação de Colorantes na Degradação e Estabilização de Polímeros, Quim. Nova, Vol. 29, No. 1, 124-128, 2006, Saron C, Felisberti MI
- Polímeros Biodegradáveis Uma Solução Parcial para Diminuir a Quantidade dos Resíduos Plásticos, Quim. Nova, Vol. 29, No. 4, 811-816, 2006, Franchetti SMM, Marconato JC

- Degradação de Polipropileno: Aspectos Teóricos e Recentes Avanços Em Sua Estabilização, Polímeros: Ciência e Tecnologia - Jul/Set-92, Agnelli JAM, Chinelatto MA
- Avaliação da Biodegradação de Poli-(Hidroxibutirato), Poli-(Hidroxibutirato-co-valerato) e Poli-(caprolactona) em Solo Compostado. Polímeros: Ciência e Tecnologia, vol. 12, nº 4, p. 311-317, 2002, Derval S. Rosa, Queenie Siu Hang Chui, Rubens Pantano Filho, José Augusto M. Agnelli
- Degradação do Polipropileno durante a Extrusão e a Geração de Compostos Orgânicos Voláteis, Polímeros: Ciência e Tecnologia, vol. 19, nº 1, p. 79-84, 2009, Carlos A. Cáceres, Sebastião V. Canevarolo