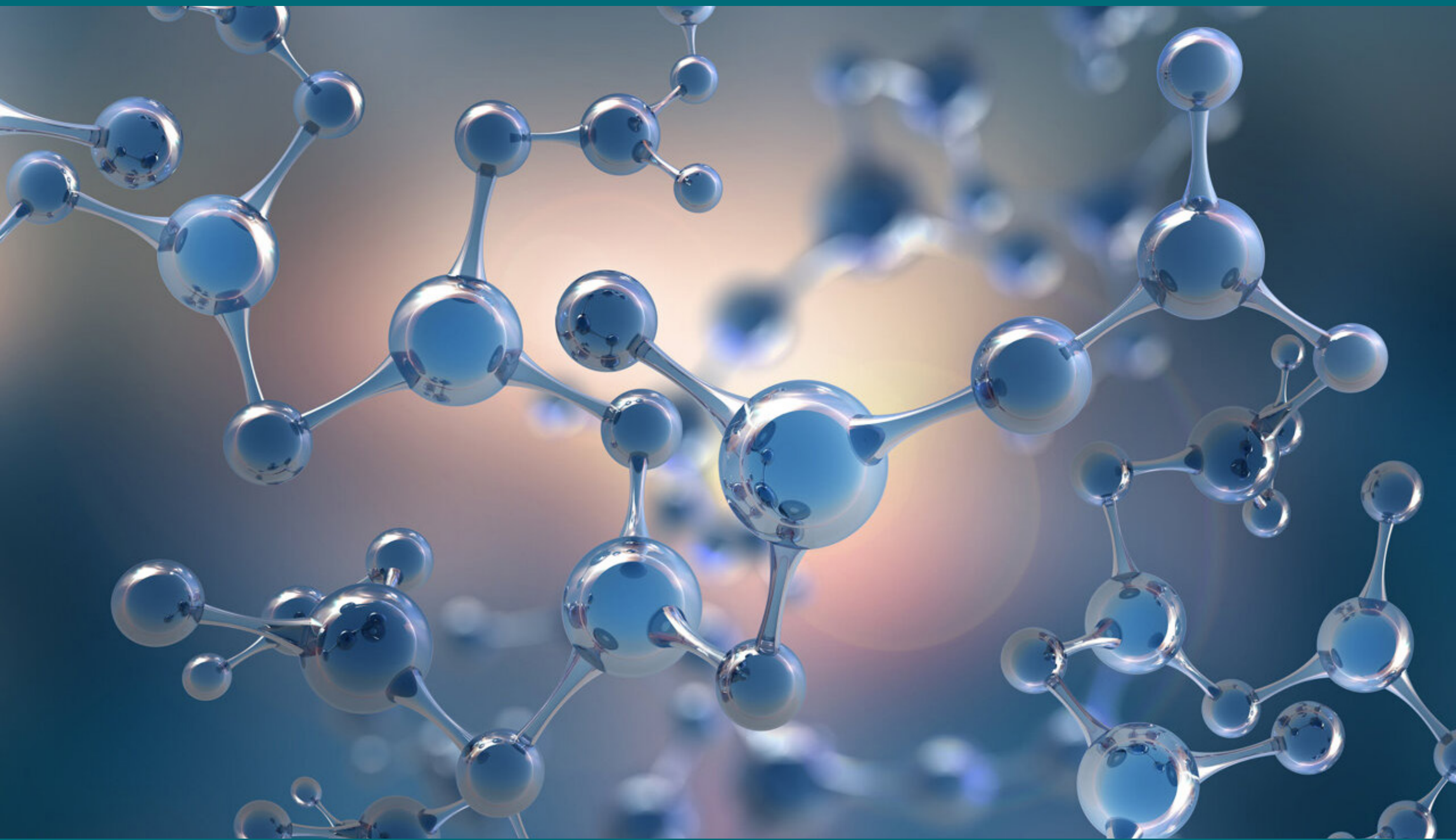
ABSTRACT BOOK



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Utilization of wood cell wall components

Wood cell walls are composed of cellulose and hemicellulose as polysaccharides and lignin as an aromatic polymer. The polysaccharide components covalently combine with lignin to form lignin-carbohydrate-complex (LCC). The LCC is reported to form micelles in water and the micelles behave as inclusion compounds for organic matters. In this study, amphiphiles, mimicking the LCC structure and function,were prepared from several kinds of isolated lignin and unbleached pulp, and then characterized.

Lignin amphiphiles were synthesized by coupling the isolated lignin and polyethylene glycols (PEGs)with diepoxy moieties. The lignin-based amphiphiles exhibited surface activity to lower the surface tension of water, which were found to be useful as a cement dispersant. Furthermore, they had a ability to keep cellulase activity at a high level in enzymatic saccharification of unbleached pulp for bioethanol production.

When increasing the lignin concentration at the above coupling reaction, not amphiphiles but lignin-based gels were formed. The gels showed unique swelling behaviors: swelling in aqueous organic solvents but shrinking in pure water or organic solvents. Very recently, these gels were found to swell in organic solvents containing inorganic salts, leading to develop a gel-type separator for secondary batteries.

Cellulose bearing lignin (i.e., unbleached pulp) was also converted to another amphiphile by hydroxypropylation with propylene oxide. This amphiphile played a role of inclusion compound as well as LCC. The amphiphile were further transformed into a responsive gel to human body temperature by crosslinking with epoxylated PEG mentioned above. The summary of these LCC-mimicking amphiphiles will be introduced in my oral presentation.

Biography:

Yasumitsu Uraki, Professor.

I graduated from the Department of Polymer Science at Hokkaido University in 1984 and got my Ph.D.in 1989 for studies on chitin and chitosan derivatives. Since I got an academic position at Faculty of Agriculture, I haveworked in research on wood chemistry. As my initial research, I developed lignin-based carbon fibers and activated carbon fibers, which led to the production of parts of energy storage devices.

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Artificial Intelligence (AI) in Biomedical Engineering

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. Recent advances and applications of artificial intelligence (AI) in medicine via emphasizing this research area with novel biomaterials technology have shown great interest in medical applications. The way AI rapidly processes large amounts of information and arrives at likely causes for symptoms can drastically reduce the diagnosis-treatment-recovery cycle for many patients. The present seminar is divided into two parts; in the first part I will discuss the basic principle of the AI technology. In the second part, I will discuss the recent applications of AI technology in healthcare. I will further show some of our recent project in which AI technology has been used in biomedical engineering including in cancer, diabetes, biosensor, and tissue engineering.

Biography:

Dr. Hossein Hosseinkhani, Chemical Engineer, has 30 years of experience in biomedical engineering in both academia and industry in biomedical engineering research and development, which includes several years of basic science research experience in a number of premier institutions related to the structure and function of biomaterials, and in polymer-based medical implants development in the medical device industry. He is inventor of 22 International patents, several of which are licensed to companies acting in the biomedical fields and translated to 7 commercial products. He authored more than 100 scientific papers published on peer-reviewed Journals, 5 books (H-index: 46 Google Scholar). He is the founder of Matrix, Inc. a world leading biotech company dedicated to healthcare technology to improve patient's quality of life.

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Biomimetic multifunctional fibrous membranes by electro spinning technique aspromising scaffolds for regenerative medicine

In the regenerative medicine/tissue engineering sector, many researches are currently focalized on the design of biomimetic multifunctional composites able to simulate the composition and/or the microstructure of the tissue to be regenerated [1]. The interest towards the development of fibrous membranes has been progressively increased in the last years, presenting applications in numerous sectors, e.g., tissue regeneration, filtration, drug delivery, functional and active packaging [2]. They can be fabricated by electro spinning, a low-cost, user friendly and versatile technique, which has recently emerged as a very promising approach in the regenerative medicine. This approach can generate structures which well resemble those of the native tissue extracellular matrix typical of different biological tissues, and the fiber surface can be also properly modified and functionalized in order to improve the biological response and to drive the stem cell fate both in vitro and in vivo [3,4]. Moreover, the electro spinning can occur at environmental conditions, and, thus, is very appropriate to encapsulate and stabilize thermo labile substances (biomolecules, drugs, growth factors, antioxidants, antimicrobial agents..), ensuring their controlled release and providing specific functionalities [4,5]. Honeycomb like and hierarchical microstructures can be realized by selecting the process parameters and the solution/suspension features [6]. Furthermore, recently many efforts have been dedicated to the reprocessing and re-use of agro-food waste byproducts and extracts, in the context of the Circular Economy, for the formulation and development of ecosustainable alternatives to the traditional materials and for a smart and sustainable waste management [7]. In this framework, electro spun fibrous mats were successfully produced, using synthetic, natural and agro- food waste derived biopolymers, extracts and byproducts, as well as biocompatible inorganic fillers. The obtained systems were characterized in terms of micro structural, thermal, mechanical and biological characteristics by scanning electron microscopy, X- ray diffraction, FT-IR spectroscopy, differential scanning calorimetric, uniaxial tensile tests, cytotoxicity tests.

Biography:
Ilaria Cacciotti, Full Professor of Biomaterials & Tissue Engineering and Materials Science & Technology at University of Rome "Niccolò Cusano". Ilaria Cacciotti graduated in Medical Engineering at the University of Rome "Tor Vergata" (Master of Science Award 'Fondazione Raeli'), completed the Ph. D in Materials Engineering (Ph. D Thesis Award 'Marco Ramoni 2011, Ph. D Thesis AIMAT Award 2012) and obtained the II Level Master degrees in "Forensic Genetics" and in "Protection against CBRNe events". She is expert in the synthesis/processing/characterization of biocompatible nanostructure materials, particularly for applications in the biomedical/environmental/agri-food sectors. She is member of the Editorial Board of several international journals, including Applied Science-MDPI, Applied Surface Science Advances-Elsevier, Frontiers in Biomaterials, Open Journal of Materials Science-Bentham Science. For her research activity, she received more than 20 awards, including the L'ORÉAL-UNESCO Italy for Women and Science 2011.

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From Laboratory to Commercial

The goal of most research is to develop a new process/product, improve an existing product or improve an existing process. Even very fundamental research has the goal of eventually evolving into a commercial product/process. This then brings up the question what are the steps in commercialization and when should they be initiated. The focus of this paper is limited toearly-stageprocess development. This involves both the transformation of bench scale chemistry into a process basis and confirmation that the final design will be both economical and operable.This process basis will provide sufficient detail that it can be used for detailed design. The initial steps in developing this process basis consist of a technology/operability/economicanalysis and review. These steps should explore such items as reactor design scaleup (heat removal and kinetics), vendor equipment scaleup techniques, safety, raw material sourcing, pilot plant needs and other items. The most efficient way to develop this process basis is with a 2-step approach. In the first step, the concept developed in the laboratory is reviewed to test the viability of the process. The second step is a "study design" or a "prototype design" to assess the economic viability of the process. This protype design should be in sufficient detail to allow development of investment and operating cost estimates.Once these two steps have been completed, it is very likely that areas will be identified where additional research effort is required to confirm assumptions, reduce costs or reduce product grade slate complexity. While this presentation will focus on the process aspects of a new project, there is a parallel effort to confirm product viability.

Biography:
Joe Bonem is a Texas (USA) based engineering consultant specializing in the area of polymers. Prior to entering the consulting business as the owner of Process Engineering and Polymers Consulting, he was employed by ExxonMobil Chemicals in the fields of elastomers and plastics. He has been involved in all phases of engineering activities associated with polymers from development and design to manufacturing. Development activities have included techniques for evaluating research efforts at an early stage to allow optimization of skilled resources. He has authored a book on scale up and commercialization of laboratory developments titled Chemical Projects Scale Up -How to go from Laboratory to Commercial. In addition to this book, he has written 2 other books dealing with a unique engineering approach to technical problem solving. He has been involved with companies in the UK, Europe, Japan and the Middle East.

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Mesoporous Silica Nanoparticles (MSNs) for Controlled Drug Delivery, Cellular Uptake and Gold Nanoparticles in Hydrogel for Catalytic Applications

Nanoparticles (NPs) have been extensively used in a wide range of applications, such as, controlled drug delivery, biomedicine, sensors, catalysis and optoelectronics due to their unique electronic properties, high surface to volume ratios and good biocompatibility. However, issues like aggregation, non-dispersibility of NPs in aqueous medium invariably crops up.Therefore, NPs are incorporated into polymer matrices and particularly, in-situ synthesis of metal NPs in the polymer matrices is gaining importance currently.

In the present work, we report on the synthesis of Mesoporous Silica Nanoparticles (MSNs) with ordered pore structure as carriers for the anticancer drug, curcumin inside the porous structure. MSNs were functionalized with amine groups and further attached with carboxymethyl cellulose (CMC) using EDC coupling chemistry.The in vitro release of curcumin from the –NH2 and CMC functionalized MSNs (MSN-cur-NH2 and MSN-cur-CMC) was performed in 0.5% aqueous solution of Sodium Lauryl Sulphate (SLS). The effect of CMC functionalization of MSNs towards cellular uptake was studied in human breast cancer cell line, MDA-MB-231. The MTT assay study revealed that curcumin loaded MSN-cur-CMC showed better uptake of curcumin in cancer cells. The work shows that CMC functionalized MSNs can be used as potential carriers for loading and release of hydrophobic drugs in cancer therapy.

We also demonstrate a simple and convenient method for generating and immobilizing Gold NPs (Au-NPs) into polyethylene glycol-polyurethane (PEG-PU) hydrogel matrices and their catalytic application for a model reduction reaction of 4-nitroaniline (4NA) to p-phenylenediamine (p-PDA) in the presence of sodium borohydride.The gold NPs immobilized PEG-PU hydrogel matrices could be reused for 28 cycles yielding a total turnover number of 3220.

Biography:

Current Research Interests: Stimuli-responsive polymers and hydromel's, Nan particles in Hydro gels Chemistry and technology of Superabsorbent polymers (SAPs) Water-soluble polymers and hydrophobic ally modified associating polymers Polymeric Adhesives for Automotive Applications Electro spinning of polymers for bio-medical applications Education: Ph. D. (Chemistry), University of Bombay, India, 1989 B. Sc. (Tech)[Polymers], UDCT, Bombay, India, 1982 B. Sc. (Chemistry), Karnataka University, Dharwad, India, 1979 Experience: Jan-March 2016 Visiting Professor to Kyushu University, Fukuoka, Japan Nov 2008 Visiting Professor to University of Pierre and Marie Curie, Paris 2019 July- Emeritus Scientist, SIR-National Chemical Laboratory, Pune 2014- 2019, Chief Scientist (Scientist G), CSIR-National Chemical Laboratory, Pune 2008- 2014, Scientist F, CSIR-National Chemical Laboratory, Pune 2002- 2008, Scientist E-II, CSIR-National Chemical Laboratory, Pune 1997- 2002, Scientist E - I, CSIR-National Chemical Laboratory, Pune 2004, 2005, 2006(one month each time) Visiting Scientist, ESPCI, Paris, France 1997-1999, Humboldt Fellow, University of Mainz, Germany 1992-1997 Scientist - C, CSIR-National Chemical Laboratory, Pune 1991-1993, CEC post-doctoral Fellow, University of Strathclyde, UK,1992 March, Visiting Scientist, Virginia Tech, USA 1987-1992, Scientist - B, CSIR-National Chemical Laboratory, Pune, June - November 1982, Technical Officer, COSMO FILMS LTD., Bombay Achievements: Author/Co-author of more than 100 papers in refereed International journals ;5US Patents Project Leader in Projects funded from DST, CSIR(NMITLI) New Delhi; P&G, USA; Ranbaxy, Gudgeon; IFCPAR, New Delhi; CAL, Faridabad; RGSTC, Mumbai Recognized by Pune University for guiding students for their PhD and M.PhilChemistry and Engineering degrees (15-Ph Ds completed) Life Member of the National Magnetic Resonance Society of India, Bangalore Life Member of the Society for Polymer Science (SPS), India; Secretary, SPS Pune Chapter (2009-2012), President SPS Pune Chapter 2014- Life Member of the Asian Polymer Association (APA), New Delhi Life Member (LM-61) of Society for Advancement of Natural Resins and Gums (SANRAG), Ranchi Vice-President, Humboldt Academy, Pune, In the Editorial Board of Trade Science Inc. Macromolecules, An Indian Journal (TSI Journals- Media for Rapid Publication) Fellow of Maharashtra Academy of Sciences Scientist of the Year Award 2009 from CSIR-NCL Research Foundation 45 Invited talks in International conferences: India, Nepal, Germany, France, UK, Italy, Turkey, South Korea, Japan. Member of the Research Council (RC) of Biomedical Technology wing of Sree Chitra Tirunal Institute of Medical Science and Technology (SCTIMST), Trivandrum Member of the CSIR-URDIP Task Management Committee (TMC), Pune.

Matej Bracic

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Applicationofpolymers in paperpreservation

Paper is the most important carrier of information about our culture, science, economy, politics and history. Degradation of historical paper documents is a cause of great concern. Degradation is caused by physical, chemical and biological factors that can be broadly divided into endogenous (acidity, metal ions, lignin or degradation products) and exogenous (heat, moisture, UV light, oxygen, pollutants or biodeteriogens).
Paper pH is a key determinant of paper degradation and longevity. Smith estimates that the U.S. Library of Congress loses US$179,000 each day due to acid hydrolysis of books during storage. In addition, biological contaminants, such as fungi, cause additional paper deterioration of already acid-degraded paper artifacts. Excreted fungal metabolites cause the decomposition of cellulose, sizing agents, and fillers, resulting in a gradual loss of mechanical strength and loss of information.
Much progress has been made in developing deacidification treatments to combat acid degradation, including coating with alkaline nanoparticles. Some efforts have also been successful in inhibiting fungal attack. However, there are no commercial treatments that would successfully prevent acid degradation of the paper and also provide an antifungal effect. Nonetheless, recent advances in the application of functional polymers to paper artifacts have opened up new possibilities for combating acid degradation. In this presentation, the potential of some of the best studied polymers, such as polysaccharides and silicon-containing polymers, will be presented. Preparation of functional colloidal formulations, paper treatments, analytical tools and new insights into preventing paper degradation will be presented.

Biography:
Matej Bračič received his PhD at the Laboratory for characterisation and processing of polymers, Institute of engineering materials and design, Faculty of Mechanical Engineering, University of Maribor, Slovenia in 2016 and received a post-doctoral position in 2018. He established international cooperation with the Instituto de Química Avanzada de Cataluña in Spain, Friedrich Schiller university in Germany, Technical University Graz in Austria, and National Institute of Technology, Warangal in India. His primary research topic is studying interactions of molecular and polymer dispersions in liquids with solid surfaces and their biological evaluation by means of quartz crystal microbalance (QCM-D) as well as material preparation (spin-coating, electrospinning). He has knowledge in preparation and physicochemical characterisation of colloidal dispersions of alkaline particles and polysaccharides in polar and non-polar solvents. He is currently working as a senior researcher at the Laboratory for characterisation and processing of polymers, Institute of engineering materials and design, Faculty of Mechanical Engineering, University of Maribor, Slovenia. He is currently coordinating a national ARRS project related directly to the current project proposal researching $CaCO_3$ nanoparticle dispersions in non-polar solvents and cellulose-based dispersing agents and their performance as deacidification agents for acidic paper artifacts. He is supervising of one post-doc, one MsC and one PhD student. He is coordinating a bilateral project between Slovenia and India. As a project partner he is coordinating one additional Slovenian national (ARRS) project and is involved as a researcher in 2 additional ARRS projects.

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Challenges in development of PLA/CNC Nanocomposites

In this study, the effect of molecular weight and crystallizability of PLA matrix on the PLA/CNC nanocompositemorphology was systematically investigated using rheological experiments. PLA/CNC nanocomposites containing 1,3,5,7, and 10wt% of CNC were prepared using solution casting method. The comparison of the effect of PLA molecular weight indicated that CNC could form a percolation network at lower contents when low molecular weight PLA was used as the matrix. This finding attributed to the easier interpenetration of shorter PLA chains and CNC nanoparticles in the solvent. On the other hand, it was observed that the use of PLA with higher crystal liability caused further reduction of the onset of CNC percolation network concentrations. This was because during the solvent evaporation step, which was at around 85oC, the isothermal cold crystallization of PLA around the dispersed CNCs could become more favorable and thereby the heterogeneous crystal nucleation could prevent the driving force of the CNCs towards aggregation.

Keywords: Polylactide, Cellulose Nano crystals, Nanocomposites, CNC dispersion, rheological properties.

Biography:

Associate Professor Reza Nofar is the Director of Sustainable & Green Plastics Laboratory at the Metallurgical and Materials Engineering Department, Istanbul Technical University, Istanbul, Turkey. He received his MSc and PhD from Concordia University (Montreal, Canada) and University of Toronto (Toronto, Canada), respectively, in 2008 and 2013. Prof. Nofar research interests are polymer processing and theology, biopolymers and polylactide, polymer blends and nanocomposites, microcellular polymer foams, and micro fibrillated composites. Dr. Nofar has been the recipient of several prestigious awards such as 2021 Outstanding Young Scientist Award by Turkish Academy of Sciences, 2020 PPS Early Career Award,2020 Parlar Research Award and, Turkey 2017 Young Scientist Award. Dr. Nofar is the author of two books published by Elsevier in 2017 and 2021, which are, respectively, entitled Polylactide Foams and Multiphase Polylactide Blends. He has also contributed his research output as4book chapters, 3 patents, over 80journal articles, and over 90 conference papers. More information about Dr. Nofar, his research activities, and his research group could be found at: www.SGPL.itu.edu.tr.

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Effect of the hallo site addition on thermal stability of polystyrene

Priority area of the modern chemistry and materials science is development of polymeric nanocomposites with controllable properties. Harsh conditions of polymer operation in power engineering and in chemical, petroleum, and pulp-and-paper industries impose stringent requirements upon the thermal properties of the polymer materials. Effective way to meet these requirements is insertion of fillers into polymer matrix.

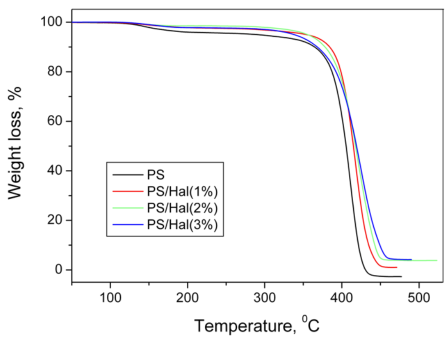
Of particular interest as filler for polymer materials is hallo site (Hal). Introduction of hallo site particles improves the thermal properties of polymer systems. Polystyrene (PS) is well-known film-forming polymer often used for various modifications with low molecular compounds of special properties, including hallo site. Because of non-polarity, PS can be selected as a convenient object in studies on the filler's effect on thermal behavior for composite.

In this study, we have prepared the samples of the polystyrene/halloysite composite films with the Hal concentration in the range from 0 to 3 wt. %, and researched an effect of the hallo site content on the structure, surface morphology and, in particular, on the thermal destruction of the composite.

Pure polystyrene films and ppolystyrene/hallo site composite films were fabricated by casting from the toluene solutions. The thermal gravimetric (TG) measurements were performed by the TG 209 F1 thermal analyzer (Netzsch, Germany) using platinum crucibles in argon atmosphere.

Figure shows the TG and curves for pure polystyrene film and polystyrene film filled with 1, 2 and 3 wt. % of hallo site. It can be seen in Figure there are two steps in the TG curve. The first step is observed in the temperature range from 115 to 190 0C. Probably, this mass loss (1~4 wt. %) is caused by the solvent evaporation out of the film.

The second step in the TG curve is attributed to the actual degradation of polymer. It is observed in the temperature range from 390 to 450 0C. The thermo grams of PS/Hal composites have clearly indicated that the second stage of decomposition of the composite were shift to higher temperature as compared to pure polymer. It means that the incorporation of hallo site enhances the thermal stability of polystyrene.



Biography:

Dr. Olga V. Alekseeva studied Chemistry at the Ivanovo Institute of Chemistry and Technology (USSR) and graduated in 1977. She received her PhD degree (physical chemistry) in 1988 at the Institute of Solution Chemistry of the Russian Academy of Sciences. From 1995 to the present time, she has been working as a senior researcher at the Institute of Solution Chemistry of the Russian Academy of Sciences (Ivanovo, Russia). From 2003 to 2011, she combined her scientific activities with pedagogical work at the Ivanovo State University of Chemistry and Technology, as an associate professor at the Department of Chemistry and Technology of Higher Molecular Compounds. Research interests: obtaining and studying the properties of functional hybrid materials for use as medical materials, as well as sorbents for removal of harmful and toxic substances from aqueous and aqueous-organic media.

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