

G.E. Zaikov, M.I. Artsis

N.M. Emanuel Institute of Biochemical Physics Russian Academy of Sciences

4 Kosygin str., 119334 Moscow, Russia

GEZaikov@yahoo.com, chembio@sky.chph.ras.ru

THE XVIII ANNUAL CONFERENCE "RECENT ADVANCES IN FLAME RETARDANCY OF POLYMERIC MATERIALS"

The XVIII Annual BCC (Broadcasting Communication Company) conference "Recent Advances in Flame Retardancy of Polymeric Materials" was held on May 21-23, 2007 in Holiday Inn Select Hotel (Stamford, Connecticut, USA).

Traditionally the conference has been chaired by Prof. Menachem Lewin from Brooklyn Polytechnic University (Brooklyn, NYC, USA).

The problem of flammability of polymeric materials is very important for practical application. Consumption of flame retardant chemicals is projected to reach 3.4 billion pounds worldwide by 2010, according to the latest forecast from BCC Research. With such a strong growth it is imperative that professionals in the field keep up-to-date on the latest advancements and applications in flame retardancy (FR).

The XVIII Annual Conference on Recent Advances in Flame Retardancy of Polymeric Materials has been a premier technical event of such type in the USA. Global experts in the field have discussed the latest technological findings in flame retardant materials and their important contributions to aviation, automotive, computer, construction, electronics, and telecommunications industries. This event provides an exclusive forum for FR professionals interested in scientific technologies used in design and manufacturing of fire-resistant materials and end products.

Research scientists, chemists, design engineers, product development managers, marketing directors, business development executives, and consultants involved in technological advancement and commercial application of flame retardant polymeric materials benefited from attending this event.

Attendees at this meeting:

- learn the latest technological advancements in FR;
- discover new applications and markets for FR products;
- get an understanding of consumer, environmental, and regulatory issues affecting the FR field;
- review new developments in standardization and testing technology;
- network with leading FR researchers and business executives;
- benefit from a wealth of knowledge accumulated throughout the 18-year history of the conference.

About 100 scientists from 30 research centers of universities, academic institutes, and companies from 12 countries (USA, Canada, Mexico, UK, France, Germany, Israel, South Korea, Belgium, P.R. China, Poland, and Russia) have taken part in this conference.

An Intensive Short Course (Selection, Evaluation, and Commercial Application of Flame Retardants) was run before the conference (on May 20, 2007). Course Director was Prof. M. Lewin and topics discussed included:

- principles of flammability and fire hazards;
- flame retarding polymers;
- review of flame-retardant chemicals;
- mechanisms of flame retardancy;
- fire tests methods;
- survey of flame retardancy of all significant plastics and textile fabrics;
- discussion of material flammability and environmental effects;
- standards-making and regulatory organizations;
- properties measured by fire tests.

The conference program has included five sessions. Prof. Serge Bourbigot (Laboratoire Procédés d'Elaboration de Revêtements Fonctionnels, Ecole Nationale Supérieure de Chimie de Lille, France) has been the chairman of the first session (General Papers and Reviews). During the opening ceremony Prof. M. Lewin has informed the participants about currently increasing topicality of the subjects discussed (due to the increase in production of polymers and polymeric materials).

The first session has had three plenary lectures. Dr. Stanislav I. Stoliarov (Galaxy Scientific Corp., Egg Harbor Twp., NJ, USA) coauthored by Dr. Kenneth D. Smith and Dr. Phillip R. Wastmoreland, (Chemical Engineering Dept., University of Massachusetts in Amherst, Amherst, MA, USA), Dr. Richard E. Lyon (FAA Technical Center, Fire Safety Branch, Atlantic City International Airport, NJ, USA) and Dr. Marc R. Nyden (National Institute of Standard and Technology, BFRL, Gaithersburg, MD, USA) has presented information about a new reactive molecular dynamics model of polymer pyrolysis. Drs. M. A. Fichera and C. Jager (Federal Institute for Materials Research and Testing, Berlin, Germany) coauthored by Drs. B. Scharrel, U. Braun, and K. H. Pawlowski (from the same institute) have delivered a lecture about solid state NMR for monitoring the thermal decomposition of flame

retarded polymers. A lecture of Dr. W.-K. Ho and Dr. J. K. Walker (The Sherwin-Williams Company, Cleveland, OH, USA) has been devoted to problems of smoke suppression by mixed-metal Cu (II) oxides in commercially formulated flexible PVC. The contributors have touched upon a topic of a new synergistic effect.

The title of the second session of the conference has been "Halogen and Non-Halogen Flame Retardants". The chairman of the first part of the session was Dr. Gerald Kirshenbaum (Adjunct Professor, Polytechnic University, Brooklyn, NYC, USA). Three reports have been presented. The problems of flammability screening of flame retardant plastics have been considered in the lecture of Drs. Richard E. Lyon, Richard N. Walters and Mark Beach (Fire Safety Branch, Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City International Airport, NJ, USA), Dr. Frederick P. Schall (The Govmark Organization, Inc. Farmingdale, NY, USA). Prof. Peter R. Hornsby (Queen's University in Belfast, UK) delivered a speech about maximizing the fire retarding performance of hydrate mineral filler, while a report of Dr. Gaille Fontaine, Prof. Serge Bourbigot, Dr. Sophie Duquesne and Prof. Rene Delobel (Laboratoire Procudus d'Elaboration des Revktements Fonctionnels (PERF0, LSPES-UMR/CNRS 8008, Ecole Nationale Supurieuse de Chimie de Lille (ENSCL), France) has been dedicated to synthesis and evaluation of new flame retardant phosphorus agents.

Prof. William Herbert Starnes, Jr. (Dept. of Chemistry, College of William and Mary, Williamsburg, VA, USA) has been the chairman of the second part of the second session. This part has included five reports. The lecture of Drs. G. Squires and R. Thomas (Ameribrom, Inc., Fort Lee, NJ, USA) and P. Georlette, I. Finberg, and G. Reznick (ICL-IP, Beer Sheva, Israel) has been devoted to benefits of complex flame retardant systems on properties of plastic composition. A lecture of Drs. F. Laoutid, N. Cinausero, E. Leroy, and J. M. Lopez Cuesta (Ecole des Mines a'Alps, Centre des Maturiaux de Grande Diffusion, France) and Dr. A. Piechaczyk (Nexans Research Center, Lyon, France) have given gave information about fire retardant systems involving nanomeric alumina. Reactive flame retardants based on phosphorus for some chain-growth polymers have been presented in a talk of Profs. John R. Ebdon and Barry J. Hant (The Polymer Centre, Dept. of Chemistry, University of Sheffield, Brook Hill Sheffield, UK) and Dr. Paul Joseph Fire (SERT, School of the Built Environment, University of Ulster at Jordanstown, Newtownabbey, Northern Ireland, UK).

Two last reports of this part have been dedicated to phyllite as a new flame retardant synergist for PC/ABC blend containing triphenyl phosphate (Dr. Seogjun Kim, Dept. of Nano and Chemical Engineering, Kunsan National University, Kunsan, Korea), and approaches to flame

retardancy of polyurea for naval applications (Dr. Usman Sorathia, NAVSEA, Carderock Division, West Bethesda, MD, USA).

The title of the third session has been titled "Nanocomposites and Flame Retardancy". This session has consisted of four parts. The chairman of the first part has been Dr. P. J. Wakelyn (National Cotton Council, Washington, DC, USA). This part has included three lectures. Dr. Gunter Beyer (Kabelwerk EUPEN AG, Belgium) has spoken about PVC nanocomposites and new nanostructured flame retardants. The report of Prof. Menachem Lewin, Dr. Jin Zhang, Prof. Eli Pearce (Polytechnic University, Polymer Research Institute, Brooklyn, NYC, USA), and Dr. Jeffrey Gilman (National Institute of Standards and Technology, Building and Fire Research Laboratory, Gaithersburg, MD, USA) have presented information about an effect of organo-layered-silicate layer (OLS) on flame retardancy of polyamide-6. The problems of polymer nanocomposites with and without conventional flame retardants (reaction to fire and synergy) have been discussed in a lecture of Prof. Serge Bourbigot, Dr. Sophie Duquesne, Dr. Gaille Fontaine, and Dr. Charaf Jama (Laboratoire Procudus d'Elaboreation des Revktements Fonctionnels (PERF), LSPES-UMR/CNRS 8008, Ecole Nationale Supurieuse de Chimie de Lille (ENSCL), France).

The second part of the third session has been chaired by Prof. Ryszard Kozlowski (Institute of Natural Fibres, Poznan, Poland). Four lectures have been included in this part. Prof. Charles A. Wilkie (Dept. of Chemistry, Marquette University, Milwaukee, WI, USA) has shared information about nanocomposites and fire retardancy (how do they fit together). The lecture of Drs. Yuan Hu, Dandan Yang, Lei Song, and Yong Tang (State Key Lab of Fire Science, University of Science and Technology of China, Anhui, P.R. China) has been devoted to the problems of synthesis and combustion property of polypropylene/IFR/ZRP nanocomposites. Information about fire retardant polymer nanocomposites based on transition metal ion modified organoclays has been presented in a lecture of Drs. Pranav Nawani and Benjamin S. Hsiao (Chemistry Dept., Stony Brook University, Stony Brook, NY, USA). The last report of this part dedicated to thermodynamic compatibility of nano-additives and polymers has been delivered by Dr. Marc R. Nyden (NIST, Building and Fire Research Laboratory, Gaithersburg, MD, US).

The third part of the third session has included three reports. The chairman of this part has been Dr. Usman Sorathia (NAVSEA, Carderock Division, West Bethesda, MD, USA). Information about extinguishing polymer blend nanocomposites has been provided in a lecture of Drs. M. Rafailovich, S. Park, S. Zhao, M. Si., J. Sokolov (Dept. of Materials Science, SUNY Stony Brook, Stony Brook, NY, USA) and Dr. Takashi Kashiwagi (NIST, Gaithersburg, MD, USA). A group of authors

The XVIII annual conference "Recent advances in flame retardancy of polymeric materials"

(Prof. G. E. Zaikov, Drs. S. M. Lomakin and A. D. Rakhimkulov from N. M. Emanuel Institute of Biochemical Physics, Moscow, Russia, Drs. I. L. Dubnikova and S. M. Berezina from N. N. Semenov Institute of Chemical Physics, Moscow, Russia, Prof. R. Kozlowski from Institute of Natural Fibres, Poznan, Poland, Dr. Gyeong-Man Kim and Prof. G. H. Michler from Martin-Luther-University, and Halle-Wittenberg, Merseburg, Germany) have given presentation about thermal degradation and combustion of polyethylene nanocomposites. The last report of this part has been dedicated to oxidative annealing, migration, and slow combustion of polypropylene nanocomposites (Dr. Yong Tang and Prof. Menachem Lewin, Polymer Research Institute, Polytechnic University, Brooklyn, NY, USA).

The chairman of the fourth part of the third session has been Prof. Gennady E. Zaikov (N. M. Emanuel Institute of Biochemical Physics of Russian Academy of Sciences, Moscow, Russia). Four lectures have been given in this part. Dr. Jeanne M. Hossenlopp from Marquette University (Dept. of Chemistry, Milwaukee, WI, USA) has spoken about key issues in optimizing layered metal hydroxides as nanocomposite additives for polymer fire retardancy. Study of relationship between rheological and flammability properties of flame retarded poly(butylene terephthalate) containing nanoclays has been presented in a lecture of Drs. S. Nazare, T. R. Hull, B. Biswas (Centre for Materials Research and Innovation (CMRI), The University of Bolton, UK). A lecture of Drs. Guoqiang Qian, Tie Lan (Nanocor, Inc., Arlington Heights, IL, USA) has been devoted to nanoclay as fire retardant synergies. A report of Drs. Mauro Zammarrano, Richard Harris, Jr., Thomas J. Ohlemiller, John R. Shields, Sameer S. Rahatekar, and Jefferey W. Gilman (NIST, Gaithersburg, MD, USA) has dealt with flexible polyurethane foam nanocomposites.

Session four has been titled "Industrial Application and Consumer Focus". This session has consisted of two parts. Prof. Charles A. Wilkie (Marquette University) has been the chairman of the first part of the session. There have been three reports in this session. Fire performance of wood-based decking products has been discussed in the lecture of Drs. Robert H. White, Mark A. Dietenberger, Nicole M. Stark (USA Forest Service, Madison, WI, USA). A group of contributors (Prof. R. Kozlowski, Drs. B. Mieleniak, M. Muzyczek, and J. Mankowski from Institute of Natural Fibres, Poznan, Poland as well as Drs. C. Magnez and P. Mesnage from Institut Francais Textile EL Habillement, France) have delivered information about

flammability of lightweight, flexible insulating nonwoven made from natural fibrous raw materials. Drs. Charles Q. Yang and Hui Yang (Dept. of Textiles, Merchandising and Interiors, University of Georgia, Athens, GA, USA) have spoken about a new flame retardant finished nomex/cotton blend fabric for protective clothing.

The chairman of the second part of the fourth session has been Dr. Gunter Beyer (Kabelwerk EUPEN AG, Belgium). This part included four reports. The lecture of Drs. David D. Jiang from Corning Inc. (USA) and Emmanuel P. Giannelis (Cornell University, USA) has dealt with thermal and fire performance of polystyrene (crosslinking, nanocomposite). Influence of flax degumming system on flammability of fibres has been presented in a lecture of Prof. R. Kozlowski and Drs. K. Bujnowicz, D. Wesolek, J. Mankowski, B. Mieleniak, M. Muzyczek, and W. Koncewicz from Institute of Natural Fibres (Poznan, Poland). Dr. Georg J. Fechtman from Underwriters Laboratories Inc. (Melville, NY, USA) have presented a speech about application of UL94 flammability testing for different polymers. The last report of this part of the session has been delivered by Drs. Michael Blaszkiewicz, Paul Bowman, and Michael Masciantonio from Bayer Material Science LLC (Pittsburgh, PA, USA) where information about understanding of repeatability and reproducibility of UL94 testing has been discussed.

The last fifth session has been titled "Testing and Standards" and included 3 lectures. Sergei Levchik (Supresta LLC, Ardsley, NY, USA) has been the chairman of the session. A lecture of Drs. Raymond B. Dawson, Susan D. Landry, and Veronique Steukers from Albemarle Corp. (Baton Rouge, LA, USA) has been devoted to flame retardants (current issues and regulatory status). Dr. P. J. Wakelyn from National Cotton Council (Washington, DC, USA) has spoken about potential USA textile flammability regulations under consideration. The last report (K. Carpenter, J. Huczek, M. Janssens, and A. Saucedo from Southwest Research Institute (San Antonio, TX, USA) has been dedicated to prediction methods of construction products performance using the ASTM E 84 Steiner Tunnel Test.

The conference has showed that the problems of flammability of polymeric materials are very topical and of great importance for pure and applied chemistry. The next XIX Annual conference will be held in the same location in May 2008.

