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20TH ANNUAL RECENT ADVANCES IN FLAME RETARDANCY OF POLYMERIC MATERIALS

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The 20th Annual Recent Advances in Flame Retardancy of Polymeric Materials Conference was held in the period of June, 1–3 2009 in Holiday Inn Stamford Downtown Hotel (Stamford, Connecticut USA). This conference was organized by BCC Research (WA, USA). Prof. Menachem Lewin (Polymer Research Institute, Polytechnic University, Brooklyn, NY, USA) was chairman of this meeting.

BCC Research organized Intensive Short Course (May, 31 2009). The main ideas of this course were selection, evaluation and commercial application of flame retardant polymers.

Prof. Edward Weil (Polymer Research Institute, Polytechnic University, Brooklyn, NY, USA), Dr. Sergei Levchik (Product Development Manager, ICL – IP America, Ardsley, NY) and Dr. Marc. L. Janssens (Director of the Department of Fire Technology, Southwest Research Institute, San Antonio, TX) were course instructors (teachers). Topics which were discussed in the course:

- Principles of flammability and fire hazards
- Flame retarding polymers
- Review of flame-retardant chemicals
- Mechanisms of flame retardancy
- Fire test methods
- Survey of flame retardancy of all the significant plastics and textile fabrics
- Material flammability
- Standards-setting and regulatory organizations
- Properties measured by fire tests

About 100 scientists and engineers from 35 research centers (USA, Canada, UK, Switzerland, China, France, Italy, Belgium, Hungary, Germany, Israel, Poland, Norway and Russia) took part in this conference.

The conference benefits were:

- Network with colleagues including expert speakers in Flame Retardancy
- Discover the latest technological advances
- Learn about leading commercial applications
- Hear the latest regulatory, environmental, and testing findings

The presentations at the conference included:

- Create a forum for introducing new technological achievements and developments in the field of flame retardancy (FR)
- Offer an overview of the current state of science and technology in FR
- Review the applications and markets for FR products
- Present recent developments in local and global standardization in testing technology
- Discuss toxicity and environmental issues
- Provide a unique opportunity for newcomers to become acquainted with the FR field in all its aspects
- Discuss halogen-based nanoparticles effects on flammability
- Address regulatory issues for flame retardancy.

Prof. Menachem Lewin took part in the opening ceremony. Scientific program of the conference included 6 sessions. The first session with the title “General Papers and Reviews” included 7 reports. Dr. Gerald Kirshenbaum was chairperson at this session. The title of the first review (Edward Weil) was “A 20-Year Perspective at the BCC Conference and Flame Retardancy—Looking Back and Looking Forward”. The role of thermal decomposition kinetics in polymer flammability was discussed in the report by R.E. Lyon and R.N. Walters (Airport and Aircraft Safety R&D Division, Federal Aviation Administration, Atlantic City International Airport, NJ) and N. Safronava, S.I. Stoliarov (SRA International, Linwood, NJ).

Marc R. Nyden (Building and Fire Research Laboratory, National Institute of Standards and Technology, Gaithersburg, MD), Stanislav I. Stoliarov (SRA International, Egg Harbor Twp., NJ), Venkat Ganesan and Landry Khounlavong (Department of Chemical Engineering, The University of Texas at Austin) gave presentation about recent developments in modelling the dispersion and agglomeration of carbon nanotubes in polymers. J. E. J. Staggs (Energy Resources Research Institute, University of Leeds, UK) spoke about effective thermal conductivity of intumescent chars by direct numerical simulation.

The last 3 reports of the first session were about experimental-modelling approach for predicting radiation

and conduction heat transfer through a uniform highly charring foam (K. L. Erickson, M. C. Celin, R. E. Hogan, V. F. Nicolette, J. H. Aubert, Sandia National Laboratories, Albuquerque NM), kinetics and flame spread issues in fire science: towards virtual design of materials (Guillermo Rein, BRE Centre for Fire Safety Engineering, The University of Edinburgh) and phosphoramidate flame retardants: mechanism and application (Sabyasachi Gaan, Viktoriya Salimova, EMPA, Material Science and Technology, St. Gallen, Switzerland; Joelle Grutzmacher Levalois, ETHZ, Swiss Federal Institute of Technology, Zurich, Switzerland).

The problems of halogen and non-halogen flame retardants were discussed at the second session. Chairperson: Richard E. Lyon. This session had 8 reports. Preparation and combustion of flame retardant shape-stabilized phase change materials were presented in the talk of Yuan Hu, Ping Zhang, Lei Song (State Key Laboratory of Fire Science, University of Science and Technology of China, Anhui, China). Group of the scientists from The Dow Chemical Company, Midland, MI (Mark Beach, Ravi Shankar, Michelle Hudack, Bill Stobby, Ted Morgan, Bruce Gerhart, Oleg Korobeinichev, Steve Vozar, Volker Sick) gave information about fundamental studies of the mechanistic action of phosphorus and sulfur as key elements for flame retardant activity in polystyrene-flame retardant blends.

Flame-retarding performance of phosphorus compounds in epoxy resins was discussed in the report of Manfred Doering, Jan Diederichs, Michael Ciesielski (Institute of Technical Chemistry, Karlsruhe Research Center, Karlsruhe, Germany).

The last five reports of the second session were devoted to the next problems: firebreak ZB and talc performance in intumescent coating (Saied H. Kochesfahani, Forrest Hentz, Rio Tinto Minerals, Denver, CO; Jean-Jacques Pauly, Frederic Jouffret, Rio Tinto Minerals, Toulouse, France); innovative flame retardant systems for thermoplastic polymers based on a novel phosphorus technology (Ugo Zucchelli, Norberto Gatti, Italmatch Chemicals S.p.A, Genova, Italy); a novel halogen-free flame retardant for flexible polyurethane foams (Fu-Lin Huang and Yu-Zhong Wang, Center for Degradable and Flame-Retardant Polymeric Materials, College of Chemistry, Sichuan University, Chengdu, China); halogenated aryl siloles as precursors to flame retardant polymers/oligomers (Bob A. Howell and Young-Jun Cho, Center for Applications in Polymer Science, Central Michigan University, Mt. Pleasant, MI) and biodegradable flame retardant nanocomposites (Miriam H. Rafailovich, Seongchan Park, Tadanori Koga, Department of Materials Science and Engineering, State University of New York at Stony Brook; Ezra Bobo, University of Pennsylvania, Philadelphia, PA; Kimberley Leonard, Dix

Hills High School, NY; Joshua Rosenbaum, Yeshiva of Flatbush High School, Brooklyn NY).

The seven reports about nanocomposites in flame retardants were included in the third session where Ryszard Kozłowski (Institute of Natural Fibres, Poznan, Poland) was chairman. Charles A. Wilkie (Marquette University, Milwaukee, WI) spoke about recent advances in the use of latered double hydroxides in fire retardancy. Feng Yang, Gordon L. Nelson (Florida Institute of Technology, Melbourne, FL) gave information about new observations on the flammability of nanocomposites. Polyhedral oligomeric silsesquioxane (POSS) nanocomposites at elevated temperatures (migration and creation of new surfaces) were discussed in the presentation of Menachem Lewin. The talk of Dr. Gunter Beyer (Kabelwerk EUPEN AG, Eupen, Belgium) had the title “New Nanostructured Flame Retardants—Fiction or Reality?”.

The last three presentations of this session were devoted to the problems of strategies for adapting nanomaterials for fire retardancy of polymeric materials (Jeanne M. Hossenlopp, Marquette University, Milwaukee, WI); interfaces in polyolefin based fire retarded nanocomposites (Gy. Marosi, B.B. Marosfői, B. Bodzay, A. Toldy, P. Anna, Budapest University of Technology and Economics) and nanoclays for use in PVC (Doug Hunter, Southern Clay Products).

The 4th session “Consumer Focus and Industrial Products” included 8 reports. Gennady E. Zaikov (N.M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, Moscow, Russia) was chairperson of this session.

Information about low antimony trioxide flame retardant plastics for electrical and electronic applications was presented in the talk of S. Levchik, G. Alessio, I. Finberg, R. Shtekler Y. Bar-Yaakov, P. Georlette (ICL-IP, Beer Sheva, Israel, ICL-IP America, Ardsley, NY). The report of E. Pikacz, B. Schartel, BAM Federal Institute for Materials Research and Testing, Berlin, Germany) was about flame retardancy in PC/silicon rubber blends using BDP and additional additives. Efficiency of FR coating for PVC cables installed in tunnels was discussed in the report of H. Breulet (ISSeP- Accidental Risks, Liege, Belgium).

The next report was devoted to the problems of accelerated weathering of fire-retardant-treated wood for fire testing (Robert H. White, USDA, Forest Service, Forest Products Laboratory, Madison, WI). Aleksander Prociak, Slawomir Michałowski and Jan Pielichowski (Cracow University of Technology); Krzysztof Bujnowicz and Ryszard Kozłowski (Institute of Natural Fibres, Poland) spoke about fire behaviour of rigid foams modified with glycolysates of polyurethane waste. The group of scientists (Mauro Zammarano, Szabolcs Matko, Jeffrey W. Gilman, Building and Fire Research Laboratory, National Institute of Standards and Technology, Gaithersburg, MD) gave information about influence of carbon nanofiber typology

on cell structure, foamability and flammability of polyurethane foams.

The last two reports of this session were devoted to the problems of flame retardant finishing of cotton fleece using nontraditional flame retardants (Charles Q. Yang, Xialing Wu, Department of Textiles, The University of Georgia, Athens, Georgia) and materials in navy applications (Usman Sorathia, Naval Surface Warfare Center, Carderock Division).

The problems of environmental and toxicity issues of nanocomposites were discussed on the fifth session. This session included 5 reports. The report of Frederic Luizi, Michael Claes, Marie Del Tedesco (Nanocyl Sa, Sambreville, Belgium) was about carbon nanotubes, an advanced solution for fire protection latest developments and relation with HSE and regulatory matters. The report of Ravi Mosurkal, Jason W. Soares, Romy Kirby, Wayne Muller, Lynne A. Samuelson (U.S. Army Natick Soldier Research Development and Engineering Center Natick, MA), Phillip R. Westmoreland (Department of Chemical Engineering, University of Massachusetts, Amherst, MA) and Jayant Kumar (Center for Advanced Materials, University of Massachusetts, Lowell, Lowell, MA) included information about novel organic-inorganic hybrid copolymers as environmentally safe flame retardant materials.

Toxicological profile of unique nano-sized type discussed in lecture of Bernd Friede (Elkem AS Materials, Kristiansand, Norway). Nanoclay/organoclay toxicology considerations were presented in talk Karl Kamena (Southern Clay Products, Austin, TX).. Dr. Anna A. Stec (Centre for Fire and Hazard Science, University of Central Lancashire, UK) spoke about fire toxicity of fire retarded polymer nanocomposites.

The 6th session “Standardization and Testing of Nanocomposites” included 5 presentations. Convective heat transfer in the cone calorimeter was discussed in the report of M. Janssens, C. Gomez (Southwest Research Institute®, San Antonio, TX). The report of Marcelo M. Hirschler and Timothy T. Earl (GBH International, Mill Valley, CA) was about plastic siding, US regulatory requirements and fire safety. G. E. Zaikov, A.D. Rakhimkulov, S.M. Lomakin, A.N. Shchegolikhin (N.M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, Moscow, Russia); I. L. Dubnikova (N.N. Semenov Institute of Chemical Physics of Russian Academy of Sciences, Moscow, Russia) and R. Kozłowski (Institute of Natural Fibres, Poznan, Poland) included in presentation information about thermal degradation and combustion behavior of polypropylene/multi-walled carbon nanotube composites.

The last two reports of this session were devoted to the problems of flame retardants—regulatory issues and sustainable use (Susan D. Landry, Albemarle Corporation, Baton Rouge, LA) and testing and environmental data of flame retardant polymeric materials (L. Ferry, JM Lopez Cuesta, D. Perrin, P. Slangen, L. Tibiletti, H.

Vahabi, Ecole des Mines d’Ales, Cedex France).

The 20th Annual Recent Advances in Flame Retardancy of Polymeric Materials Conference showed that pure and applied chemistry have real success in recent advances in flame retardancy of polymeric materials.

The next annual BCC conference will be held at the beginning of June 2010.

