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## Information 18th Annual Conference Degradation and Stabilization of Fiber-Forming Polymers

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## Information 18th Annual Conference Degradation and Stabilization of Fiber-Forming Polymers

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The 18th Annual Conference on Degradation and Stabilization of Fiber-Forming Polymers were held on September 15–17, 1993 in the Bolton Institute of Higher Education (Bolton, Lancashire, UK). The Conference was organized by Sub-group on Polymer Degradation Discussion of the Macromolecular Group of the Royal Society of Chemistry (Dr. A. Davis, the Chairman, Ministry of Defense, Fort Halstead, Kent; Professor N. S. Allen, the Secretary, Department of Chemistry, Faculty of Science and Engineering, the Manchester Metropolitan University). These meetings are traditional, and the previous conference was held in 1992 in honor of Professor Gerald Scott (Aston University, Birmingham), who is a world renown expert in the area of photodegradation and lightstabilization of polymers.

About 60 scientists from United Kingdom, USA, Switzerland, Japan, France, Czechia and Germany contributed in current conference, although the majority of lectures were given by British speakers. The program of the conference included 8 invited lectures, 8 contributed lectures, and 5 posters, and was completed as specified. Among invited lectures, the communication of Professor Norman Billingham (University of Sussex, UK) entitled “Polymer oxidation reactions: homo or heterogeneous?” was of special interest. This lecture promoted lively discussion as the declaration of heterogeneous mechanisms of oxidation of solid polymers was absolutely in contrast with ideas developed by many well-known scientists for the last 25 years. In this case, all rate constants of radical-molecule and radical-radical reactions that have been measured in polymers—especially below glass temperature—become only effective (not true) constants. Regrettably, the speaker did not mention the contribution of the scientists at the Institute of Chemical Physics of the Russian (USSR) Academy of Sciences, i.e., Professor N. M. Emanuel, Professor A. L. Buchachenko, Professor Yu. A. Shlyapnikov, Professor V. Ya. Shlyapintokh, in the development of this field of polymer science. In previous years, Dr. Yurii Mikheev was also very active in the study of heterogeneous and heterophase reactions of oxidation of polymers.

The experts in the area of chemical fibers and textile chemistry were quite interested in the lecture of Professor I. Holme (Department of Textile Industries, University of Leeds, UK) on degradation and stabilization of wool fibers. The contribution of the morphology and chemical structure of wool in the stability of fibers under effect of heat, oxygen, light, and water was discussed in detail. Attention was focused on the principal amino acid residues involved in degradation, and on changes in the end groups, side chains, and scission of the protein chain molecules as a result of degradation.

The lecture of Professor J. S. Crighton (Department of Textile Industries, University of Leeds, UK) dealt with the degradation and stabilization of cellulose textiles. Degradation was identified with change in fiber or fabric properties, whereas flammability was excluded from the examination. Methods for the sensitive identification of degradation in cellulosic fibers and its monitoring was reviewed, and factors associated with the fine structural details of the fibrous substrates were discussed in terms of their influence on degradation mechanisms and their rates. The speaker discussed some ideas about possible inhibition of the loss of properties, and the main strategies should be: (a) the prevention of the initial deterioration by the addition of appropriate stabilizers or through other ways, and (b) the introduction of intermolecular crosslinks to counter the consequences of chain scission.

Dr. J. N. Weber (DuPont Nylon, Wilmington, DE, USA) described the recent research of his company in the area of aging and stabilization of nylon fibers. The special attention was focused upon thermo-oxidation, photo-oxidation, and hydrolytic degradation. The importance of the study of environmental and biodegradation was emphasized, and novel additives for substantial improvement of the performance of nylon fibers were presented.

The flame retardant systems for textiles was overviewed in the lecture of Dr. A. R. Horrocks (School of Textile Studies, Bolton Institute, UK). The problem of flammability of textile materials was considered in reference to chemical and morphological structure of fibers. The mechanisms of flammability and well-known flame retardants were compared to show possible ways to avoid combustion gas toxicity and to be relevant to the general environmental acceptability of using flame retardants. Of particular note was the need to minimize emissions such as carbon monoxide and dioxins during burning. The possible moves away from the use of bromine and its replacement by char-forming and intumescent systems were explored.

The problems of stabilization and gas fading of polypropylene fibers were considered in the lecture of Dr. Manji Sasaki and colleagues from Osaka Research Laboratory and Tsukuba Research Laboratory (Japan). The authors had recently developed a new semi-hindered phenolic antioxidant, which exhibited a high performance and good resistance to discoloration. The performance and mechanisms of this antioxidant were discussed especially in the field of fiber application. Some results of X-ray crystallographic analysis of this and other stabilizers was also shown as a factor of performance.

Professor N. S. Allen (Centre for Archival Polymeric Materials, Manchester Metropolitan University, UK) gave a lecture on the photofading and stability of

dyed polymer materials. The mechanism of photodiscolouration and contribution of many factors (light, heat, oxygen, water, pH, etc.) in the photodegradation of fibers had been discussed.

The lecture of Professor P. Gugumus (Ciba-Geigy Limited, Basle, Switzerland) on stabilization of polyolefin fibers was met with great interest. The first part of the presentation was addressed to the various aspects of stabilization of polyolefin fibers with special emphasis on stabilization for long-term heat-aging and UV exposure. It was found that very often the combination of light stabilizers of the HALS type give optimum performance if protection against both thermooxidation and photooxidation are taken into account. In the second part of the lecture the mechanisms and kinetics of stabilization with HALS were examined. The formal kinetics approach to the thermostabilization with HALS was proposed and successfully applied to a quantitative interpretation of long-term heat aging data.

The contributed speakers discussed more specific problems. Particularly, Dr. L. Audouin and coauthors (ENSAM Research Centre, Paris and EDF/DER Research Centre, Moret sur Loing, France) considered the thermal oxidation reactions of EPDM terpolymer materials and some elements in the oxidation reactions heterogeneity. The mechanisms of chemiluminescence of polyamide-12 were reported in the communication of Dr. A. Tcharkhtchi and his colleagues from aforesaid ENSAM Centre. These mechanisms were discussed with regard to the hypothesis that the chemiluminescence is linked to monomolecular or bimolecular decomposition of hydroperoxides.

An essential contribution was made at the conference by the staff of the Bolton University, UK. Central topics included the flame retardant mechanisms of ammonium polyphosphate in polyacrylonitrile (J. Zhang, A. R. Horrocks and M. E. Hall), the effect of carbon black on the oxidation of polyolefins (M. Miraftab, J. Mwila, A. R. Horrocks), and TGA study of the pyrolysis mechanisms of untreated and flame retardant treated cotton fabrics under a continuous flow of nitrogen.

Thermal degradation of cellulose insulation in electrical transformers was presented by Dr. A. M. Emsley (Department of Chemistry, University of Surrey, UK). Dr. Sahar Al-Malaika (Aston University, Birmingham, UK) reported results of her successful cooperation with Drs. C. Rautenberg, I. Bauer and W. D. Habicher (Institute of Organic and Fiber Chemistry, Dresden, Germany) on the study of the efficiency of HALS-phosphite-combinations as thermostabilizers for polymers. The problems of alkaline hydrolysis of modified PET fibers were discussed in the lecture of Drs. J. Militky and I. Xuyen (Technical University of Liberec, Czechia).

The poster session also made a substantial contribution in the conference, and the majority of these communications were discussed in details. The posters that should be especially mentioned included "Stabilization of PVC with Pre-heated Ca and Zn Stearates," by Drs. R. Banavides, M. Edge and Professor N. S. Allen (Manchester Metropolitan University); "Connecting Stabilizers with Organic Polymers by Siloxane Chains," by Drs. I. Jansen, H. Friedrich and K. Ruhlmann (Technical University of Dresden); and three posters by the scientists from Bolton University: "Photofading of Three Reactive Dyes in Cellulose Film," (J. P. Binkley, S. C. Phillips, D. J. Hill and A. R. Horrocks); "Environmental Aspects of Flame

Retardant Textiles," (D. Roberts, M. E. Hall and A. R. Horrocks); and "Novel Flame Retardant Textiles" (D. Sanderson).

We should emphasize the high level of the fundamental research in the area of aging and stabilization of polymers and polymer fibers, which the conference demonstrated. From this point of view, the fact that the proceedings of the conference are not to be published is of our regret, although we do have all of the abstracts presented.

The next conference will be held in autumn 1994.