

HISTORY OF THE INTENSIVE SHORT COURSE

Versions of the intensive short course on Polymer Rheology and Processing have been presented by Prof. J. Vlachopoulos in Canada, Greece, Sweden, Venezuela, Mexico, USA, Finland, Czechoslovakia, Belgium, Brazil, Australia, Japan, Germany, Italy, Luxembourg, Spain and Netherlands. Over 1,800 polymer professionals have attended the lectures and provided their suggestions for improvement of the course content and the presentation style. The present international intensive short course will cover fundamentals, recent developments and will show how to use rheology to solve practical problems in the polymer industry.

LECTURER

Dr. JOHN VLACHOPOULOS started teaching at McMaster University after receiving his doctorate from Washington University, St. Louis, Mo., USA. He served as department Chairman (1985-88) and he is currently Professor Emeritus of Chemical Engineering and Past Director of the Centre for Advanced Polymer Processing And Design (CAPPA-D). He was on sabbatical research leave at I.K.T. Stuttgart, Germany (1975) and CEMEF, Ecole des Mines de Paris, Sophia Antipolis, France (1981-82, 1988-89). He is the author of more than 250 publications on polymer processing, rheology and computer aided methods. Over the years he has served as consultant to several hundred corporations. With his co-workers, he has developed the commercially available POLYCAD®, SPIRALCAD, CALENDERCAD, FLATCAD, PRO-FILECAD, EXTRUCAD (renamed NEXTRUCAD), LAYERCAD, T-FORMCAD, B-FILMCAD, RHEO-MWD, XTRU-XPRT and CALCUTRUDE software packages and founded POLYDY-NAMICS, INC. He has lectured in USA, Canada, South America, throughout Europe, Japan and Australia. He received the 2001 Education Award of the Soc. Plast. Eng. (SPE) during the ANTEC in Dallas, Texas and the 2004 Distinguished Achievement Award of the Extrusion Division of SPE in Chicago and the Stanley G. Mason award of the Canadian Society of Rheology (2007). He was the President of the Polymer Processing Society (PPS) 2005-2007, and member of several professional associations. Prof. Vlachopoulos' research work and expertise includes computer simulation of several processes, extrusion instabilities and defects, calendaring, die design, coextrusion, injection molding, thermoforming, rotational molding, powder particle coalescence, film blowing, plastic wood composites (WPC) extrusion and rheology of bioplastics.

The software packages have been licensed to several Fortune 500 corporations in the USA and many other large, medium and small companies in 29 countries around the world. Some new releases will be made in 2011. www.polydynamics.com

GENERAL INFORMATION

REGISTRATION

- Tuition fee: 1265 EURO includes registration, lecture notes, the CALCUTRUDE LITE software, coffee and refreshments and two lunches.
- The number of participants is limited and it is therefore recommended that you register as early as possible.
- Companies may *substitute* a registered participant without notification, however, an advance notice would be greatly appreciated.
- For SPE members the tuition fee is 1165 EURO.
- Non-members will receive one year SPE membership.

CANCELLATION

An administration fee of 100 EURO will be charged for cancellations received two weeks before the course starts. After this date there will be no refunding of registration fees but full credit can be given for another person from the same company or full credit for the next international course. SUBSTITUTIONS MAY BE MADE AT ANY TIME.

ACCOMMODATION

The Short Course lectures will be held at MERCURE HOTEL BRUSSELS CENTRE LOUISE, Chaussée de Charleroi 38, 1060 Brussels, Belgium. Phone (+32) 2.533.66.66, Fax (+32).2.538.90.14). Rooms can be booked at 145 EURO per room per night, including breakfast (if booked before March 4, 2011). There are a lot of other hotels in Brussels city centre and Polydynamics can make alternate suggestions. All participants requiring accommodation must do their own reservations with MERCURE HOTEL BRUSSELS CENTRE LOUISE.

PREVIOUS COMPANY REGISTRATIONS FROM EUROPE AND MIDDLE EAST (Partial Listing:)

AUSTRIA: EREMA
BELGIUM: EXXON CHEMICAL, FINA RESEARCH, TESSENDERLO CHEMIE, ACE, HYPLAST, SOLVAY, VERBRUGGEN BOREALIS, SHELL RESEARCH, DSM, DPI, DECEUNINCK, N.V. ETERNIT, MOBIL PLASTICS, LIMBURGSE VINYL, DEVRO TEEPAK, GUNZEPLASTICS, MONTELL, BASELL, BAXTER, EVAL, KHLIM, ATOFINA, DUPONT TEIJIN, CERTECH, BP SOLVAY, A. SCHULMAN PLASTICS, DUPONT DE NEMOURS, EXXONMOBIL, ATOFINA ELASTOMERS, SOLVAY ADVANCED POLYMERS, TOTAL, CERTECH, MILLIKEN, ORFIT, NITTO, ALKOR DRAKA, PLASTIFLEX, BP HDPE, ETERNIT, LEUVEN HGSCH, NITTO EUROPE, CABOT, COMMSCOPE, KABEL WERK EUPEN, INBEV, COBREW, CLARIANT, TOTAL PETROCHEMICALS, POLYONE
CZECHOSLOVAKIA: VUGPT, S.P. PLASTIKA, CHEMOSVIT, CHEMOPETROL
CZECH REPUBLIC: BARLO PLASTICS, ARROW INTERNATIONAL
DENMARK: NKT ELEKTRONIK, GRINDSTED PRODUCTS, OTTO NIELSEN EMBAL., DTI, BANG & OLUFSEN, FIBERVISIONS, NOVO NORDISK, COLOPLAST
FINLAND: NESTE CHEMICALS, NOKIA, BOREALIS, OPTINOVA, NEXTROM OY, PREMIX OY
FRANCE: S.F. EXXON CHEMICAL, S.N. POUDRES ET EXPLOSIFS, MICHELIN, UNIV. ST. ETIENNE, PECHINEY, ELIOKEM, GOODYEAR CHEMICALS, LINPAC, ARCELOR, CLARIANT, TORAY PLASTICS, ARKEMA, AMN DPI, ECOLE MINES DOUAI, NEXANS RESEARCH
GERMANY: BASF, HOECHST, HENKEL, COROVIN, H. REINECKE GMBH, DOW, RÖHM GMBH, KRAILBURG TPE, FELIX SCHOELLER, CLARIANT, BORSIG, BBA, FIBERWEB, RED, BASELL, POLYPLAST MÜLLER
GREECE: EKO-CHIMICA, VOMVYKRYL A.E., COLGATE, MACEDONIAN PLASTICS, CIBA-GEIGY, PETZETAKIS, PLASTIKA KRITIS, NTU, CARINA
IRELAND: HOLFELD PLASTICS, GREGANNA MED. DEV.
ISRAEL: POLYON BARKAI, TAMA PLASTIC
ITALY: MONTEDISON, HIMONT ITALIA, SNIA TECNOPOLIMERI, MONTEFLUOS S.P.A., MONTEDIPE S.P.A., ENICHEM, ELF ATOCHEM, VIADELO, POLIMERI EURO., MOBIL, CENTROCOL ING. MAT., BAUSANO, BARILLA ALIMENTARI, EVC ITALIA, ELECTROLUX, ZANUSSI, ICMA SAN GIORGIO, METZELER, PIRELLI, PONTELAMBRO, SEALED AIR, SACMI, SIPA, SOCIETA DEL GRES, TECNOMATIC, UNILROY MILACRON, AUSIMONT, SOLVAY-SOLEXID, TECHINT POMINI, SOLVAY-SOLEXIS, CEAST, COOP BOX, PROPLAST, INEOW FILMS, TECHNE, HABASIT ITALIANA, SOJITZ, MAZER MATERIE PLASTICHE, EURONIL, MACCHI, API, RAPISARDA INDUSTRIES, AGRIPAK Srl and CHIORINO SpA
LUXEMBOURG: DUPONT TEIJIN FILMS
NETHERLANDS: GENERAL ELECTRIC B.V., PHILIPS RESEARCH, DOW CHEMICAL B.V., DSM RESEARCH, FUJI PHOTO FILM BV., AKZO, ELOCOAT, OCE NEDERLAND, TNO, MOBIL, ACORDIS, W&R PLASTICS, NV ORGANON, NB ETERNIT, NOVA CHEMICALS, DIOLEN, CORUS, COLBOND, SABIC EUROPE
NORWAY: STATOIL, SENTER FOR INDUSTRIFORSKNING, SINTEF, NORSK HYDRO A/S, BOREALIS, ELOPAK, NEXANS
PORTUGAL: INST. NAT. ENG. TECN. IND., BAQUELITE LIZ
QATAR: QATAR PETRO
ROMANIA: PRODPLAST
SAUDI ARABIA: YANBU PETROCHEMICAL CO., SABIC, AL-JUBAIL PETRO, KING SAUD UNIVERSITY
SLOVAKIA: BARLO PLASTICS
SLOVENIA: UNIV. LJUBLJANA
SPAIN: REPSOL, MERQUINSA MERC. CHIM, INST. CIE. TECH POL, AIMPLAS, GRUPO ANTOLIN, UBE ENGINEERING PLASTICS
SWEDEN: ERICSSON TELECOM, LUND INST. TECH, ROYAL INST. TECH. (KTH), NESTE POLYETEN AB, BOHLIN REOLOGI, PGI, TETRA PAK, NOKIA, KABI PHARMACIA, ABB, FERRING AB, DYNO NOBEL, BOREALIS
SWITZERLAND: EMS-CHEMIE AG., BP, NOKIA MAILLEFER, BUHLER AG, DOW EUROPE, CIBA, OB ENTERPRISE
TURKEY: GENTUG TEKSTIL, MIKROSAN
U.K.: BATTENFELD GLOENCO, GOUGH ASSOC., SYMBOLIC SYSTEMS, ICI, STEWARTS & LLOYDS, RAYCHEM, BP SOLVAY PE, DUPONT TEIJIN FILMS, IMERYS MINERALS, LONDON METRO U., MICROPOL LTD., TOTAL PETROCHEMICALS, CHEMIX, EASTMAN

66th International Intensive Short Course on POLYMER RHEOLOGY AND EXTRUSION

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LECTURER
JOHN VLACHOPOULOS
POLYDYNAMICS INC.

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Send by Post, Fax or Email as attachment to:

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For Bank Transfers, the account number etc. will be
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**66th International
Intensive Short Course
on
POLYMER RHEOLOGY
and
EXTRUSION**

APRIL 14-15, 2011

BRUSSELS, BELGIUM

WHO SHOULD ATTEND

Engineers, chemists, physicists, and managerial personnel involved with plastics extrusion, applied rheology, blow molding, mixing and compounding, reactive processing, production of synthetic polymers, recycling and process equipment design and manufacturing will find this course beneficial. Engineers will gain an increased understanding of rheological behaviour including the role of molecular structure and will learn some of the unique engineering problems associated with polymer extrusion. Chemists will learn about fluid flow and heat transfer involving polymers and troubleshooting of extrusion equipment. Managers will obtain an overview of the technical problems associated with plastics extrusion.

Everyone will benefit from learning problem solving techniques based on rheological characterization and polymer flow consid-

**FOR INFORMATION ABOUT
POLYDYNAMICS, INC.
VISIT OUR SITE ON THE INTERNET
www.polydynamics.com**

PROGRAM OUTLINE

THURSDAY, APRIL 14, 2011

9:00 - 9:30 **Welcome & Registration**

9:30 - 12:30 **Introduction to Rheology**

Unusual rheological phenomena exhibited by polymer solutions and melts. The importance of rheology in polymer processing. Viscosity, melt flow index and melt strength, and their relation to molecular structure. The role of temperature, pressure, additives and fillers. The Dow Rheology Index for Insite technology polyolefins. Rheology of metallocene polymers.

12:30 - 14:00 **Lunch**

14:00 - 17:30 **Rheology for Process Optimization**
Shear and normal stresses. Viscoelasticity. Stress relaxation. Extensional viscosity. G' and G'' measurement and significance in polymer characterization. The role of rheology in mixing and blending. Rheological modifications by blending certain polymers, such as LLDPE and LDPE. Determination of MWD from rheological measurements. Predicting processability from rheology. Viscosity of suspensions. Rheology of wood plastic composites (WPC). Rheology of some nanocomposites. Problem solving using rheology.

FRIDAY, APRIL 15, 2011

9:00 - 12:30 **Melt Flow Through Dies, Extrudate Swell, Die Lip Build-up, Sharkskin and Melt Fracture**

Unidirectional and multidimensional flows. Pressure drop and frictional heating (viscous dissipation). The mechanisms responsible for extrudate swell. Die lip build-up (drool) causes and remedies. Relation to molecular structure. Causes for the onset of sharkskin and gross melt fracture. The effects of adhesion and slip. The role of additives and processing aids. Recent theories and their application to process improvement.

12:30 - 14:00 **Lunch**

14:00 - 17:30 **Extrusion and Troubleshooting**

Principles of solids conveying, melting and melt pumping in single screw extrusion. Simple formulas for calculation of Throughput, Power and Torque. Screw design considerations and review of modern designs. Conventional versus barrier screws. Screws with mixing elements. Dies for extrusion and coextrusion. Surging, gels, screw and barrel wear, the role of moisture, interfacial instabilities, weldlines, MD Flow lines, and thickness non-uniformities. Systematic fault diagnosis and troubleshooting.

LECTURE NOTES AND SOFTWARE

• Each participant will receive a copy of the annually updated book of lecture notes on POLYMER RHEOLOGY AND EXTRUSION. This fact-filled book includes copies of the presentation slides, theory, detailed derivations of several important equations and numerous worked out problems. It is highly recommended for follow-up reading either as a quick information sourcebook or for in-depth study. It is easy to follow with the mathematical level kept to a minimum. Several key references are also given for persons wishing to continue upgrading their knowledge and understanding. It shows how to do simple calculations of shear rate, shear stress, pressure drop, temperature rise due to viscous dissipation, Rabinowitsch and Bagley corrections in capillary viscometry, rheology of composites, wall slip velocity, flow throughput in extruders and much more. Whether you want practical problem solving information and troubleshooting tips or you want to understand the importance of recent developments, you will find this book indispensable.

• Each participant will also receive a copy of the CALCUTRUDE LITE software package which enables quick calculations of important polymer flow quantities, such as pressures, shear rates, shear stresses etc. in simple flow geometries. In the opinion of the lecturer Prof John Vlachopoulos, the best way to learn rheology is by doing calculations. But, calculations can be very tedious. CALCUTRUDE LITE takes the tedium out of the calculation process.

Note: ENGLISH WILL BE USED IN ALL LECTURES AND COURSE NOTES

Questions, however, may be asked in German, French, Spanish, Italian or Greek. Dr. Vlachopoulos will translate the questions and will give the answers in English for the benefit of everyone.

For course registration or other questions contact:

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