

DUNAREA DE JOS UNIVERSITY OF GALATI

Proceeding of
The 1st International Conference on Polymers
Processing in Engineering
PPE 2007



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“DUNĂREA DE JOS” UNIVERSITY OF GALATI



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PREFACE

Polymers and polymers composites play a vital role in many applications from lightweight components for cars and aircrafts to medical devices and cell phones.

The plastics industry makes a significant contribution to the welfare in the world. According to the *PlasticsEurope* (Association of the Plastic Manufactures), in Europe, more than 1.6 million people are employed in about 50.000 companies (mainly small and medium sized enterprises in the converting sector) to create a turnover of €280 billion per year.

In this view, the aim of The 1st International Conference on Polymers Processing in Engineering, PPE 2007, was to bring together scientists and engineers, from the academic world and industry, to discuss new developments in the fields of polymers and polymer composites.

The topics fall into, but are not limited to, the following categories:

- Polymer processing;
- Rheology and rheometry;
- Biopolymers processing and biotechnologies;
- Mechanical behavior of polymers and polymer composites;
- Fracture mechanics of polymers and polymer composites;
- Reliability and testing.

The book contains the papers presented at The 1st International Conference on Polymers Processing in Engineering, PPE 2007, held in Galati, Romania, during the period 25-26 October, 2007.

The editor can not accept responsibility for any inaccuracies, comments and opinions contained in the paper.

The organizers would like to thank all authors for submitting their contributions, as well as the supporting organizations for their help.

Catalin Fetecau,
Dunarea de Jos University of Galati

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INJECTION MOLDING OF BUSHES MADE OF TRIBOLOGICAL POM: INTERACTION BETWEEN MOLD AND MOLDED MATERIAL

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Key words: Tribological Polymers, Injection Molding, Bushes.

Summary: *In this study, a tribological polymer was used to fabricate bushes by injection molding. The material was an acetal filled with molybdenum disulphide, which exhibited a strong interaction with the mold during molding. Optical microscopy, thermal and technological tests were carried out to investigate this interaction. A residual is left on the mold at every molding run and it can be carried away by the following run. As a consequence, small shining particles are visible on the bush molded surface and some scratches appear in the bearing zone. Experimental tests show that this behavior is dependent on the intrinsic nature of the molded tribological polymer.*

DETERMINATION OF THE RESIDENCE TIME DISTRIBUTION AT THE EXIT OF MIXING ZONE IN COROTATING TWIN SCREW EXTRUDER

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Key words: Residence time distribution, corotating twin screw extruder.

Summary: *The residence time distribution at the exit of mixing zone in a fully intermeshing, corotating twin screw extruder was determined with a stimulus-response technique. The operating parameters investigated were screw speed and feed rate. The residence time decreases with increasing screw speed and feed rate.*

PERFORMANCE ASSESMENT OF THE DISPERSIVE MIXERS IN PLASTICATING EXTRUSION

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Key words: Extruder, Screw, Mixing zone geometry, Barrier flight, Pressure variation

Summary. *Starting from the general relations for pressure variation established in previous papers, for Maddock and Egan mixing zones, one puts into evidence the importance of a correct estimation of the clearance value over the barrier flight. The pressure variation along the channels as well as through the clearance over the barrier flight was represented. Analyzing the influence of the mixing zone geometry upon pressure variation one obtains some practical conclusions for the design of the mixing zone.*

SOME WAYS TO INCREASE THE FLOWRATE OF A SINGLE SCREW EXTRUDER

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Key words: Screw extruder, Flowrate, Velocity gradient.

Summary: *The way leading to the increase of the flowrate of an extruder of a given geometry is discussed, while considering the real situation: barrel stationary, screw rotating; granules slide onto the screw surface and relative motion takes place, hence a velocity gradient. Parameters of the granular material in the extruder's feeding zone are looked upon taking into consideration their influence on the flowrate. Bulk density, ρ_v , friction coefficients onto the barrel and screw, and thus the flowrate coefficient, k_G have a direct influence on the general flowrate value. Increase of the term $(k_G \cdot \rho_v)$ will increase the extruder flowrate.*

THE IMPORTANCE OF THERMAL EFFECTS IN THE FLOW OF MELTED POLYMERS THROUGH INJECTION MOULDS

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Key words: Nonisothermal Polymer Flow, Rheology, Injection Mold Design.

Summary: *During the flow through injection moulds, thermal effects appear. These effects are caused by the pressure drop, the internal friction, the external friction and the convection changing with the channel wall. All these effects are equivalent with a supplementary pressure drop through channels and must be taken into account by the mould designer for rheological design in non-isothermal conditions. The paper offers the mould designer a facile solution for calculating the pressure drop in non-isothermal conditions. This way, the supplementary pressure drop effect is transformed in a supplementary length and it is introduced in isothermal pressure drop equations, making them applicable for non-isothermal flow. These new relations were experimentally confirmed.*

ANALYSIS OF THE MATHEMATICAL MODEL FOR THE POLYMERICS FLOW

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Key words: Polymer flow, injection molding, mathematical equations.

Summary: *This paper proposes a preliminary study of the governing equations for the injection molding. To be able to predict a model complex polymer flows, one must first have a basic understanding of the mathematics that govern the flow: the conservation of mass, the conservation of momentum, and the conservation of energy. In addition to these three conservation equations, there may also be one or more constitutive equations that describe material properties, shear thinning behavior. Since these equations may also be coupled together, temperature dependent viscosity, the solution can become even more complex. The goal of the modeler is to take a physical problem, apply these mathematical equations and solve them to predict the flow phenomena range.*

THE INFLUENCE OF PACKING PRESSURE AND PACKING TIME OVER THE QUALITY OF INJECTION MOLDED PIECES

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Key words: Injection molding, packing pressure, packing time, injection molded piece quality.

Summary: *Injection molding process have two important phases: 1st-the plastifying-dosing phase, which serves to prepare the optimal melting from the point of view of reological property, and 2nd – the injection and compacting phase of the melted material. During the second phases over the melted materials is applied an injection pressure, and after this, the packing pressure. The packing pressure can be development up to various values by the hydraulic system, result different values of compaction of melted material, resulting different values for the injection molded piece mass.*

STUDY REGARDING THE ANALYSIS OF THE INJECTION PROCESS OF THE TWO-COMPONENTS PRODUCTS

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Key words: Thermoplastics, Injection Mold, Two-Component, Moldflow.

Summary: *This work proposes analysis of the co injection molding of the thermoplastic materials. The material is injected in two steps. The first one is the PP body injection and the second two metal contacts with wires encapsulation.*

The second step is the EPDM sealing cup co injection. There were done the technological and the mechanical analyses of the co injection process.

The technological analyses research the optimal conditions of the injection molding and aiming at temperature, pressure and flow rate optimization in the mold cavity. The above mentioned values were used for mechanical analyses of the mold and the computation of the encapsulated contacts deflection.

ASPECTS ABOUT INJECTION MOLDS TEMPERING

Ion Postolache*, Catalin Fetecau*, Felicia Stan*

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Key words: Cooling Water, Heat Input, Specific Heat, Cold Runner Mold.

Summary. *In this paper, a comparative study for three different thermoplastic materials (HDPE 10062E, POPELEN A353, DIAPET PS507) used for “Electrical Outlet” component injection with reference to energy input required to rise the plastic temperature is presented. Also, the heat removed from the mold and the amount of coolant required for the mold cooling was calculated.*

MACHINING OF CESTILENE HD 500 THERMOPLASTIC

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Key words: Polymer machining, cutting force, strain gage.

Summary. *Since the cutting force generated during the plastic cutting process has a direct influence on the quality of the machined component, roughness, heat generation, tool wear etc., in this paper, the cutting force during the turning of the CESTILENE HD 500 thermoplastic were measured using strain gage. Cutting force signals at different cutting parameters were captured and processed using a data acquisition system based on hardware SPIDER 8 and software running on.*

INFLUENCE OF THE CUTTING CONDITIONS ON ROUGHNESS AT THE TURNING OF THE PA 66 POLYAMIDE WITH AN ATTACHABLE TIPPED TOOL

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Key words: Polyamide, Roughness, Cutting Process

Summary: *This work presents a study concerning the attainment by experiment of a mathematical model which describes the dependence between the roughness of the machined surface of a PA 66 polyamide blank and the cutting tools parameters, in the case of the turning with an attachable tipped tool, having a specific geometry, established according to literature recommendations.*

This work will also present a comparative analysis between the results obtained for this case and the results in the case of turning with a high-speed steel cutting tool.

HYPOTHESES AND PREMISES CONCERNING THE APPLYING OF NON-TRADITIONAL TECHNOLOGIES IN THE CASE OF PLASTICS

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Key words: Plastics, Technological properties, Non-traditional technologies.

Summary: *The non-traditional manufacturing technologies are based essentially on the increasing the energy available in the work zone, by different ways, so that either a traditional machining process develops under better conditions, or the machining process develops on new principles, fundamentally different in comparison with the principle of plastic deformation, considered as being the main principle on which the traditional manufacturing methods are based. There are different modalities to classify the non-traditional manufacturing technologies. Some of the non-traditional manufacturing methods suppose the including of the workpiece material within an electric circuit; such machining methods could not be generally used in the case of the non-traditional manufacturing methods or could be used only in special conditions.*

COMPOSITE FOAMS BY SOLID STATE FOAMING

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Key words: Foams, Foaming Process, Composite Materials.

Summary: *In this study a new foaming technology is investigated for the fabrication of composite foams. Commercial thermosetting powders are mixed with fillers and used to fabricate tablets by compression. Zinc powder, alumina powder and glass beads were considered as fillers. Tablets foam by addition of heat in a muffle at very high temperature, because of the resin boiling. Compression tests were carried out on composite foams to evaluate mechanical properties in dependence of the filler content. By increasing the filler content up to a medium level, the density ratio increases, as well as the compression toughness and the strength. Best results were obtained for alumina filled foams. However, at high contents, the material becomes rigid and the typical behavior of a foam is lost.*

BUCKLING OF SHIP DECK PANELS WITH INITIAL IMPERFECTIONS, MADE OF COMPOSITE MATERIALS

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Key words: Imperfect Composite Plates, Buckling, FEM Analysis

Summary. *The subject of this paper is the buckling behaviour of laminated plates, with a pre-existing initial deformation and a central circular delamination, subjected to in-plane loading. The plate is modelled as an orthotropic Mindlin plate. The analysis is carried out by using so layered shell elements, gap and coupling elements. By applying the finite element method, the plates with initial deformation (first modal shape of buckling) are studied. Numerical and experimental results for the critical buckling load are presented for several examples.*

ADVANCED MATERIALS USED IN SHIPBUILDING

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Key words: Ship structures, Advanced materials.

Summary: *The subject of this paper is to identify various innovations in materials, structural topology and regulation that are pertinent for advanced non-metallic (composite) or hybrid metal-composite marine structures. In the spite of the fact there are certain major obstacles preventing widespread use of composites in merchant ships, day by day advanced materials are using in ship structures composition.*

DRILLING OF POLYMERIC COMPOSITE MATERIALS

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Key words: Composites, Cutting, Drilling, Machining.

Summary: *Bolting of composite materials reinforced with fiber glass is a key operation when it comes to assembly. For this, trilling holes in the materials is necessary. When drilling into such materials, many problems may appear, such as high axial forces, very high temperatures at the contact zone between the tool and the material, delaminating of the material, tool wear etc.*

The result of research on the variation of the cutting force when drilling are being presented in this paper; during the experiments, three types of composite materials reinforced with fiber glass were used.

MANUFACTURING PROCESS FOR PRODUCING FRP SHIP HULL MODEL

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Key words: Ship model manufacturing, Advanced materials

Summary: *The subject of this paper is to explain and identify various innovations in the manufacturing process for producing a ship hull model made of fiber reinforced polymers to study the hull longitudinal strength (bending and torsion). The technology used for structural topology and regulation that are pertinent for advanced non-metallic (composite) is described.*

DEVELOPMENT OF PROJECTS IN RENAULT CONCEPTION WITH APPLICATION TO A LOGAN COMPOSITE PLASTIC PART

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Key words: Polymers, Injection Molding.

Summary: *The development projects in Renault conception is a basic activity witch ensure the products competitiveness. A project in Renault conceptions must follow some very important steps. In this paper, it is make a detailed presentation of these steps and base on this, it has proposed a project for implementation a composite plastic part from Logan front bonnet opening mechanism construction.*

MANUFACTURING PROCESS FOR PRODUCING FRP PANEL SPECIMENS WITH IMPERFECTIONS

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Key words: Plates manufacturing, Advanced materials

Summary: *In this paper is presented the manufacturing process for producing specimen plates made of fiber reinforced polymers to study the buckling so in the case of initial deformation and in the case of existing a circular delamination. The technology used for structural topology and regulation that are pertinent for advanced materials (composite) is described.*

TANNIC ACID AS POLYPHENOL MODEL ENTRAPPED IN CHITOSAN BASED NANOSTRUCTURE MATRICES

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Key words: Chitosan, cationic surfactant, tannic acid, structural analysis.

Summary: *Chitosan is a natural bioactive material which has a very wide range of commercial and possible biomedical applications. For this reason it had been used as matrix in combination with a cationic surfactant. Polyphenols are antioxidants characterized by the presence of several phenol functional groups. In human health, they are thought to be useful in combating oxidative stress, a syndrome causative of neurodegenerative and cardiovascular diseases. The main source of polyphenol antioxidants is nutritional, since they are found in most legumes and fruits. We used tannic acid as polyphenol model. The polyphenols are encapsulated in chitosan matrices because it is pursued the release of the polyphenols only in a certain medium. In this paper are presented studies regarding the obtaining of nanostructure membranes in which tannic acid was entrap. These systems were investigated by Atomic Force Microscopy and Scanning Electron Microscopy methods.*

POLY(AMIDEHYDROXIUREYHANE) ASSISTED NANOPARTICLES SYNTHESIS BY CONTROLLING THE MIGRATION PROCESSES

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Key words: Nanoparticles, Pamhu; Synthesis, Galvanostatic Assay, Structural Analysis.

Summary: *The majority of the synthesis routes for the nanoparticles systems make use of specific solvents (frequently very toxic) and/or high temperatures conditions. Polymers as polyelectrolytes can play an important role with regard to the formation and stabilization of particles with diameters in a range of hundred of nanometers to a few of nanometers, which are of special interest in a broad area of new applications. A special feature is presented in the case of water – soluble polyelectrolytes. Combining the basic principles of water-soluble polymers synthesis with their ability to control the nanoparticle formation process and/or stabilization, was developed new mild synthesis routes. Our studies refer to magnetite and metal silver nanoparticles synthesis rout at room temperature with the possibility of controlling the galvanostatic migration on diffusion processes in the presence of PAMHU polyelectrolytes.*

RESEARCH CONCERNING TOBACCO CULTURE USING MULTILAYER POLYMERIC PHOTOSELECTIVE FOILS

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Key words: Polymeric, Multilayer, Co-extrusion, Foils, Tobacco Culture.

Summary: *The multilayer polymeric photo-selective foils are obtained by co-extrusion of more layers and additives. These are more and more used in protected agriculture, such as greenhouses, solararia, low tunnels and provide a high economic efficiency. The paper present some aspects of protecting a tobacco culture with the above mentioned.*

WEAR ASPECTS FOR INJECTION PROCESSING OF THERMOPLASTIC MATERIALS WITH GLASS FIBER

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Key words: friction, wear, composite thermoplastics, comparative wearing coefficient

Summary: *The melted polymer's relative movement, with high speed and under great pressure, upon the metallic surfaces of the snail, cylinder and mould create a environment adequate to the appearance of the wear phenomenon. The abrasive effect of the glass fibre fitting as well as the aggression of the chemical compounds freed from the melted plastic material is added to the factors mentioned above. Industrial materials processors' experience shows that mould's and work devices' wear phenomena are of great importance in processing glass fibre filled materials.*

The studies carried out allowed for the establishing of a correlation between the wear produced to the steel. This can be done by thermoplastic compound materials with glass fibre, experimentally proved on linear contact couple [9]. The wear is produced by compound polymers melts in viscous flow on the metallic surfaces of the injection machines [8]. The comparative coefficients' values for the wear produced by different compound plastic materials to injection mould have been determined.

POLYMER USE IN MODERN ADDITIVE MANUFACTURING METHODS FOR REALIZATION OF 3D MODELS OF ANATOMIC STRUCTURES

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Key words: 3D models, stereolithography, photo resin, computer tomography

Summary: *Modern additives methods allow realization of 3D models at 1:1 scale of anatomic structures. The methods are mostly applied to bones and artery-veins structures. Necessary data are generated by computer tomography (CT). These models are useful in surgery for complex cases and precise prosthesis. The main construction methods are Stereolithography (SLA) and 3D printing (3DP). SLA is a layer additive manufacturing method, which employs an ultraviolet laser to selectively cure a liquid plastic photo resin. 3DP use two-component resin, solid and liquid. The paper analyses the necessary steps for realization of 3D models from CT data acquisition to model construction*

LOW PRESSURE POLYETHYNE

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Key words: Poly(ethane), Mitsui Process.

Summary: *This paper presents the Mitsui Process for low pressure polyethylene and the specifications for both feedstock and product. It also analyses the unit, equipment and yields.*

SYNTHESIS POLYMERS IN SPECIAL PYROTECHNICAL PRODUCTS

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Key words: Polymers, Solid Rocket Propellants.

Summary: *This paper describes the requests for polymers in order to become appropriate components of heterogeneous solid fuels for rocket engines and specific pyrotechnical mixtures. Although many polymers are commonly used, only few of them are to such applicability.*

ELECTRIC AND ELECTROMAGNETIC PROPERTIES OF FIBER FABRIC BASED FILLED EPOXY COMPOSITES

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Key words: Laminate Composite, Talc, Carbon Black, Electric Resistivity, Resonance Frequency.

Summary. *Electric and magnetic properties of laminate kevlar and carbon fiber mixed fabric based epoxy composites are investigated through experimental techniques. Powder fillers were used in order to change the basic properties of standard composite. Also effects of filled epoxy layers architecture were studied. Electric conductivity is evaluated across and along reinforcement and at the surface of the samples. Electric permittivity and resonance frequency of materials were evaluated.*

ON A NEW CLASS OF POLYMERIC MATERIALS

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Key words: polymeric materials, dendrimers

Summary: *In the frame of polymeric materials can be included dendrimers that are composed from a crowd of branched macromolecules. This category of materials having hipper branched structure presents new physical and chemical proprieties that confer a high functionality with application in medical and industrial field. In paper are summarized some main aspects presented in literature concerning the structure, properties and application of dendrimers in various domains inclusive in nanotechnology*

TECHNOLOGICAL ASPECTS ON THE FABRICATION OF ACETABULAR CUPS FROM PLASTIC MATERIALS

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Key words: Acetabular cup, plastic material, machining, compression, injection

Summary: *UHMWPE, which possesses an average molecular weight of between about 1 million and about 10 million, is used to make prosthetic devices, such as prosthetic hip joints, prosthetic knee joints and as bearing components for other prosthetic replacement joints for the human body. UHMWPE can be formed into the devices by techniques that include: (1) direct compression molding UHMWPE resin into the final shape of the device; (2) ram extrusion of a UHMWPE powder into cylindrical bar stock that is several inches in diameter, and machining the acetabular cup from the bar stock and (3) molding large sheets of UHMWPE and machining the implant from the molded sheet. The molded sheets can be up to 8 inches thick and 8 feet in both width and length.*

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SC BIBLIOTECA CHIMIEI SA București**



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