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- podporovat kontakty mezi odborníky zabývajícími se kompozitními a uhlíkovými materiály
- podporovat studenty
- vytvořit databázi odborníků
- organizovat semináře a konference

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Czech Composite and Carbon Materials Society

Aims and Scope

- to promote contacts between composite and carbon materials research specialist
- to support students
- to establish a personal database
- to organise seminars and conferences

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New technology for advanced composite structures

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Summary

Lightweight structures, which are inexpensive and have excellent mechanical properties, are recently one of the most desired concepts not only for aerospace industry, but generally for transportation and automotiveindustry. LF Technology, developed and patented by 5M s.r.o. company, is very efficient technique to produce sophisticated and relatively cheap composite structures.

Composite materials are the best materials for lightweight structures because they can be tailored to the specific application. The biggest advantage is a variability of polymer matrix and reinforcement, where reinforcement determines mainly mechanical properties/weight ratio. Initially, optimised mechanical properties should be found for every product. Then different reinforcement types, their orientation and number of layers in "every point" of composite part must be used to reach required properties and low weight. Included local sandwich structures are a big advantage. How to achieve these basic requirements? Let's focus on technologies available today. Prepregs are materials used for years, but they are very expensive and many prepreg types are necessary, if composite structure should be optimised well. RTM is a relatively cheap method, big parts can be manufactured. The main problem is impregnation of the reinforcement. Therefore only special types of the reinforcement have to be used and the result is relatively low reinforcement content in a final composite part. In recent years, technology called RFI – Resin Film infusion appeared. The production cycle is performed usually in the autoclave under increased temperature and pressure, where the fibre infiltration and the composite consolidation occur in a single step process. Typically, the RFI element consists of a thermoset resin film placed between one side of a metal tool and a dry textile fibre preform. Problems with conventional RFI appear if sandwich structures are manufactured; honeycombs are filled with resin and foam prevents from impregnation of the sandwich skin in opposite site of the resin layer.

Concerning these disadvantages of conventional processes and a need of universal low cost technology, 5M s.r.o. developed and patented a very efficient technique of production of sophisticated and relatively cheap composite structures, which is called Letoxit Foil Technology (LF Technology). LF Technology is based on laying dry reinforcement and core material to the mould with layers of foil polymer material, commercial name Letoxit Foil. Whole composition is vacuum bagged and cured at elevated temperature. The scheme can be seen in Fig. 1. Finished part is released from mould as ready to use product with excellent surface. Variability of LF Technology gives freedom to composite parts design with very competitive price. Autoclave can be employed but it is not necessary, because vacuum assistance is usually enough for reinforcement impregnation.

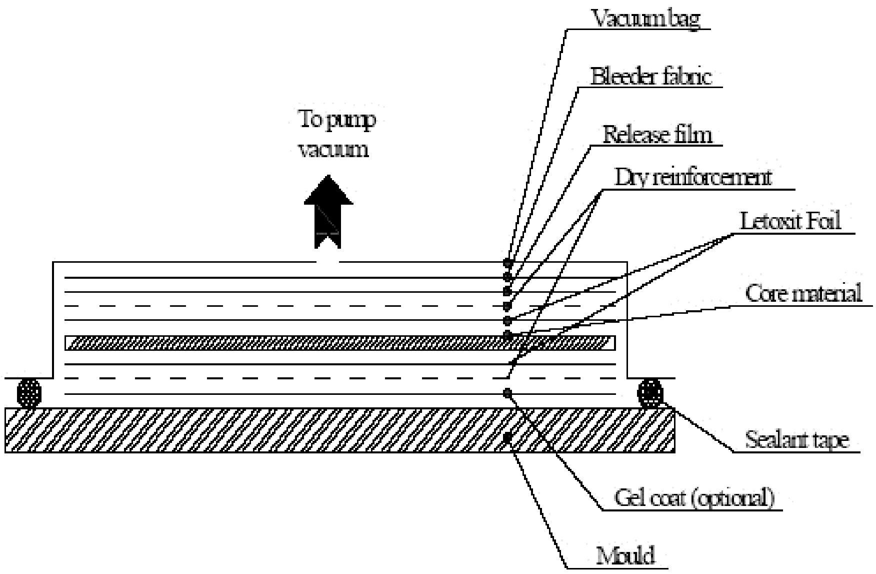

Fig.1 Scheme of LF Technology

Basic component for LF Technology is Letoxit Foil that is usually a thermoset flexible film. Basic type is Letoxit Foil LFX 023, which is composition of special epoxy resin hardeners latent at room temperature. Film colour is originally light yellow but can be set according to the customer desire. Thickness of Letoxit Foil varies between 0,1 to 0,7 mm and it is described by area weight, which is usually between $100 g/m^2$ and $700 g/m^2$. Typical curing conditions are 120°C for 1 hour but LFX 023 can be cured at any temperature between 90°C and 130°C.

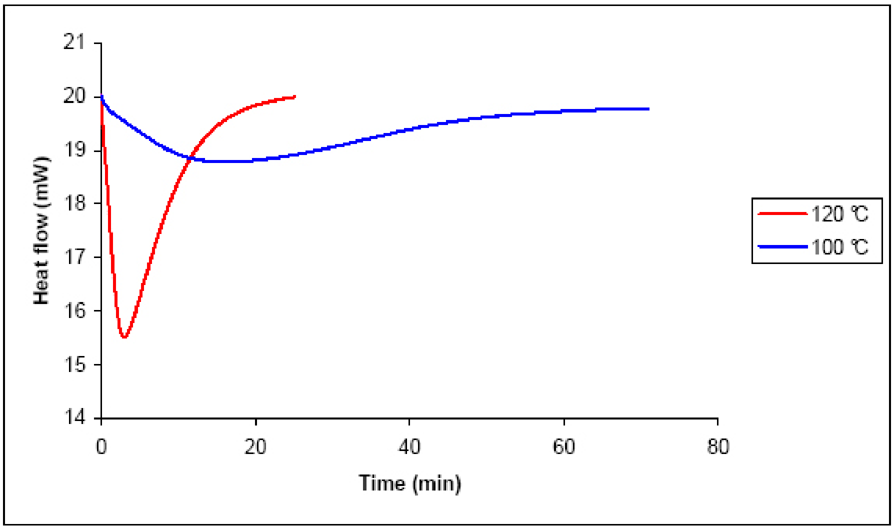

Fig. 2 Dependence of curing kinetics on curing temperature of LFX 023

Mechanical properties of cured resin strongly depend on curing condition. In graphs bellow can be seen variation of glass transition temperature, flexural properties and impact strength on curing conditions; temperature and time. Curing conditions are given at dimensionless coordinates, when temperatures were between 80 and 140 °C and curing time between 45 and 240 minutes.

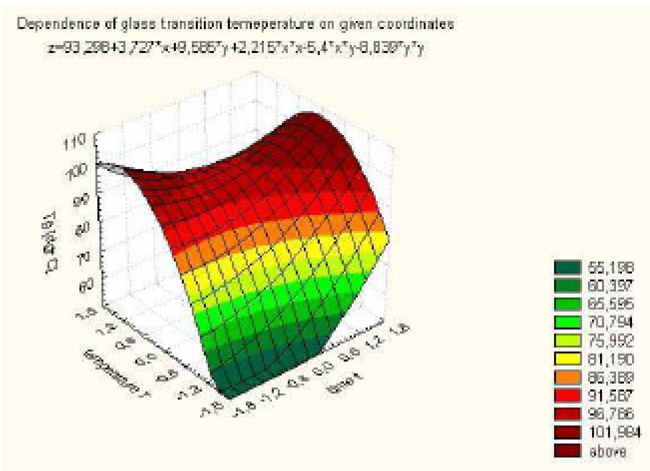

Fig. 3 Dependence of glass transition temperature on curing conditions of LFX 023

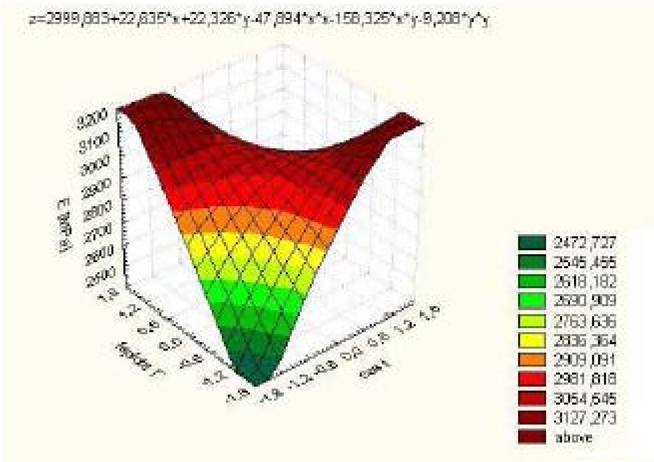

Fig. 4 Dependence of flexural modulus on curing conditions of LFX 023

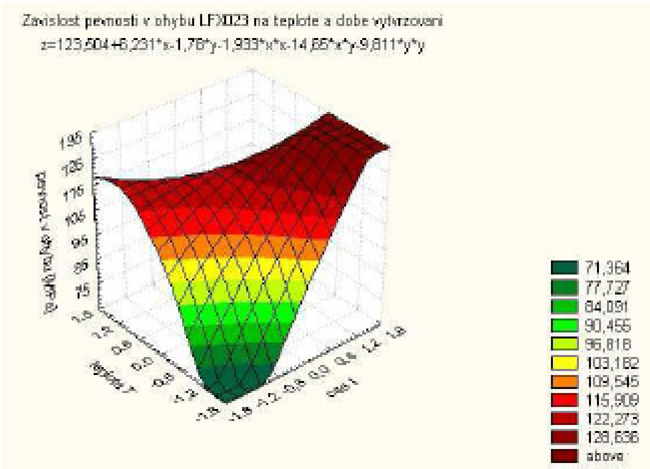

Fig. 5 Dependence of flexural strength on curing conditions of LFX 023

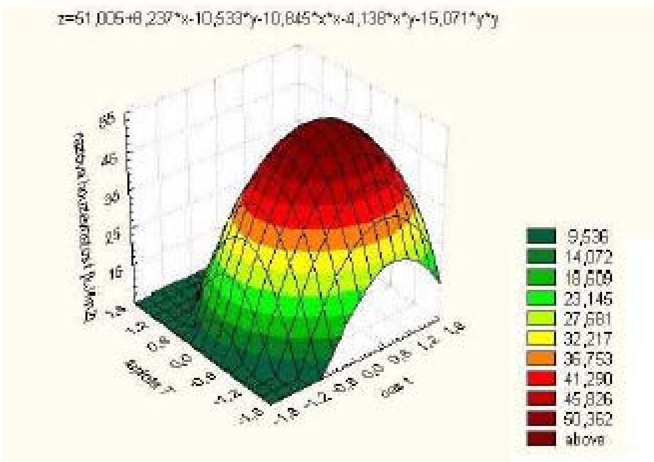

Fig. 6 Dependence of impact strength on curing conditions of LFX 023

Table I. Mechanical properties of LFX 023 cured at 120°C for 60 min

Density (g/cm^3)	1.16
Hardness Barcol	18-19
Tg (°C)	95
Ultimate flexural strength (MPa)	120-125
Flexural modulus (GPa)	3-3.1
Impact strength (kJ/m^2)	45-50

Except of LFX 023, there are several other types of Letoxit Foils available. Some of them are listed in the table bellow.

Table II Commonly used Letoxit Foil types

Name	Resin type	Advantage
LFX 023	Epoxy	Basic type
LFX 033	Epoxy	Fast curing
LFX 036	Epoxy	Tg above 150°C
LFX 037	Modified epoxy	High impact strength
LFX 038	Halogenated epoxy	Fire retarded
LFX 040	Modified cyanoester	Tg up to 250°C

Big advantage of LF Technology is variability of the reinforcement due to very simple impregnation. Also combination of different reinforcement types is possible. The most common reinforcements are fabrics, where glass, carbon, aramid and basalt are usually used. Also hybrids of these materials are possible. The most important parameters of fabrics for LF Technology are area weight, thickness and sizing. Weight ratio of fabric and Letoxit Foil depends on geometry, which is determined by area weight and thickness. Whole free space of fabric must be filled with resin and therefore appropriate thickness of Letoxit Foil must be chosen. Calculation of minimal resin content is given by equation:

$$m_{LF} / \rho_{LF} + m_R / \rho_R = t_R$$

where m_{LF} is area weight of Letoxit Foil, ρ_{LF} is density of Letoxit Foil, m_R is area weight of reinforcement (fabric, etc.), ρ_R is density of reinforcement and t_R is thickness of reinforcement. Usually, one layer of fabric is laid to the mould covered by release agent, one layer of Letoxit Foil is applied and finally one or more layers of fabric are laid. Another reinforcement types are mats, stitched fabrics, multiaxial fabrics and direct or bulky rovings etc. Setting of resin/reinforcement ratio is using the same rule as in case of fabric.

Dependence of flexural properties of carbon composite made by LF Technology under vacuum is shown below in Fig. 7 and 8. Composite samples are made from 12 layers of balanced carbon fabric 200 g/m2, type twill and LFX 023.

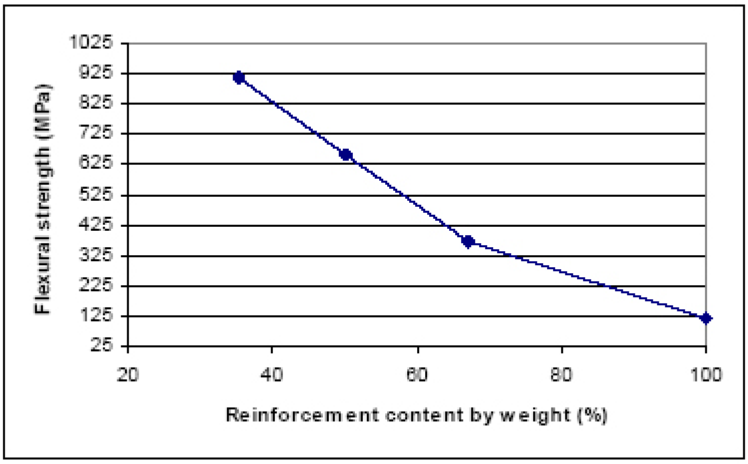

Fig. 7 Dependence of flexural strength on reinforcement content

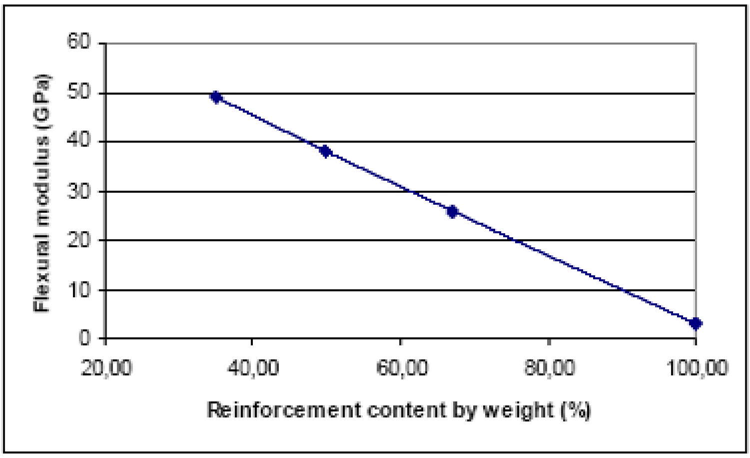

Fig. 8 Dependence of flexural modulus on reinforcement content

Composition of resin and reinforcement can be cured in different equipment. In Fig. 9 and 10 is comparison of flexural properties of carbon composite made by LF Technology cured in press (P) under vacuum in oven (V) and in autoclave (A). Results are compared with sample made of Hexcel prepreg HexPly T/45%/200T/C cured in autoclave (HEX). Curing times and temperatures were identical for all prepared samples.

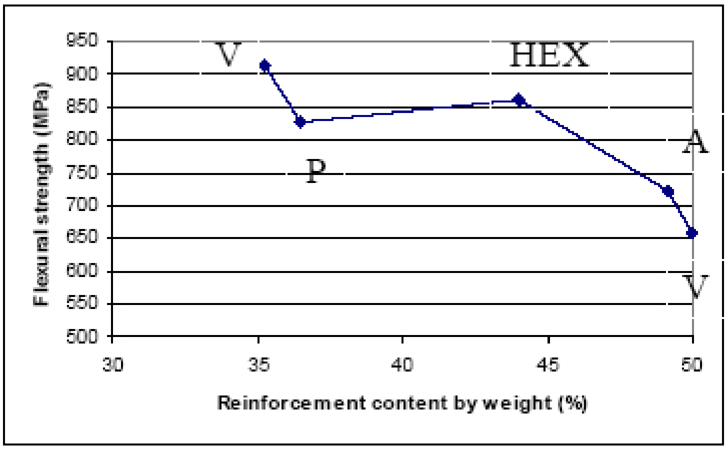

Fig. 9 Dependence of flexural strength on reinforcement content and curing equipment. Comparison with prepreg cured in autoclave.

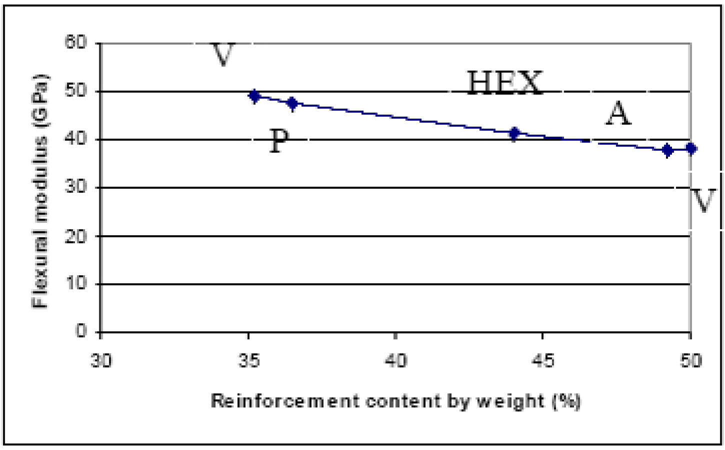

Fig. 10 Dependence of flexural modulus on reinforcement content and curing equipment. Comparison with prepreg cured in autoclave.

Main difference between LF Technology and standard RFI is the possibility of sandwich structures creation as in case of prepregs. Almost all types of core material used for sandwich structures of thermoset composite can be chosen. The most popular are honeycombs, foams and special core materials such as SORIC, COREMAT etc. Core materials can be applied locally in the composite if stiffness increase of certain area of composite part is required. This approach easily excludes ribbon necessity.
LF Technology also gives possibility of one-shot application of local reinforcements. Typical are metal ribbons or pulled profiles and inserts for screw and rivet fastenings made from steel, aluminium or composite.

Applications of LF Technology
LF Technology is suitable for any composite structure, where balanced weight and mechanical properties ratio are required. Typical applications are tin shell structures with high reinforcement volume, locally added reinforcements and/or with different required local properties (for example reinforcement orientation) because these structures cannot be manufactured by conventional technologies without highadded cost of material and work. The conventional composite structures, originally made by RTM, VARTM, Hand-lay up, are possible, of course. but due to lower requirements on mechanical properties on parts made by these conventional technologies, economy of LF technology (RFI) must be taken into account. Potential applications are:

Automotive – car bodies, covers, hoods
Transportation – hoods, side panels, doors, racks
Aerospace – covers, doors and all types of panels
Building – tables, eye-catchers
Medical – orthosis and prosthesis

LF Technology is very young and was introduced to several carefully chosen companies at the end of 2004. First interesting applications, which were developed with these partners, appeared at the beginning of 2005. Samples of developed prototypes are shown.
First application was an engine hood of ultralight aeroplane CHS 701SP, originally composite part made by hand-lay up from unsaturated polyester resin. 60% weight decrease was achieved using LF Technology This weight decrease appears and the same stiffness remains due to use of local reinforcement with Nomex honeycombs in the top of the hood. Foam was applied in the upper part. Other important benefit was higher thermal stability. Good surface of the part was achieved although gelcoat was not applied.

Fig. 11 Engine hood of ultralight CHS 701SP – prototype

Fig. 12 Carbon knee orthosis made by ING Corporation, s.r.o. (Czech Republic). LF Technology is used for carbon composite structure, February 2005

Next application was carbon knee orthosis made by ING Corporation, where Hexcel carbon prepreg was substituted. Advantages were better bonding of steel juncture and decrease of material costs with almost the same labour costs. Mechanical properties of the orthosis composite body made by LF Technology were comparable with mechanical properties of the prepreg orthosis.

Third application was a baggage wall in 4 seats airplane VUT 100, where good stiffness of baggage wall and low weight were achieved by usage of a sandwich manufactured from ROHACEL foam, glass fabrics and LFX 023.

Fig. 13 VUT 100 made by EVEKTOR. (Czech Republic). LF Technology is used for glass foam sandwich baggage wall, April 2005

Applications listed above were the first successful applications of LF technology. Logically, medical and aerospace applications were chosen, where advantages of the technology are the most significant. Obtained experiences confirmed that the target market is not only in high-tech applications but the LF Technology can be applied for all composite structures were weight and mechanical properties play important role.

Conclusion

LF Technology gives freedom to designers, helps push down prices of composite products and increases properties and reliability, which is supported by favourable responses from customers and quick and relatively easy development of new products. All these advantages promise very good future for LF Technology.

Czech-Polish Workshop on Composites as Biomaterials

25. května proběhl na našem ústavu tradiční česko-polský workshop zaměřený na aplikace kompozitních materiálů, nové směry v jejich vývoji a použití nových materiálů jako kompozitních složek.

Ceramic and carbon nanoconstituens – based polymeric composites in biomaterials engineering

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Keywords: Nanocomposite, Carbon nanotubes, Ceramic nanoconstituent

Application of nanotechnology in various aspects of medicine like diagnostics, therapeutics, controlled drug or gene delivery systems, tissue engineering requires specific nanodevices and nanomaterials. Ceramic nanoparticles such as colloidal silica, montmorylonite, carbon nanotubes and bulk carbon materials with engineered in nanoscale surface have attracted more and more interest as potential compatible components of biomaterials for different domains of medicine. The unique combination of mechanical, physical and chemical properties of nanomaterials - based polymeric composites make them attractive not only as reinforcement constituent of various matrices (to improve mechanical properties of pure polymer), but also to modify physicochemical surface properties. Previous study on nanocomposites material based on polymer matrix revealed that chemical surface state of nanocomposites, nanotopography or wettability may strongly influence the cells response (in vitro condition). However, such properties depend on the method of dispersion of nanofiller in a polymer matrix and its compatibility to this polymer.

Nanocomposites investigated at the Department of Biomaterials, University of Science and Technology (Cracow) are considered as a potential group of biomaterials which can be used as orthopedic implants (bone replacement) or in bone grafting (regenerative therapy). Such materials were designed, manufactured and studied with respect to their biomimetic mechanical behaviour and surface topography of improved adhesion and cells proliferation.

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Human bone-derived cells in cultures on materials modified with fullerenes, carbon nanotubes or nanodiamonds

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Carbon nanoparticles, namely fullerenes, nanotubes and nanodiamonds, have been considered as promising materials for advanced biomedical applications, such as quenching radicals harmful for cells, photodynamic anticancer and antimicrobial therapy, novel imaging technologies, controlled drug or gene delivery, microchips, nanorobots or biosensors [1-3]. However, relatively little is known on the influence of these nanoparticles on cell-substrate adhesion. Therefore, in the 1st set of experiments, fullerenes C60 were deposited onto microscopic glass coverslips (Menzel Glaser, Germany; diameter 12 mm) in a form of continuous or micropatterned layers using the Leybold Univex-300 vacuum system. The thickness of the layers increased proportionally to the temperature in the Knudsen cell and the time of deposition. As revealed by AFM, it was 505±43 nm or 1090±8 nm in the continuous layers. The micropatterned layers (Fig. 1A) were prepared by the deposition of fullerenes through a metallic mask with trapezoid holes (size 16000±500 μm^2, distance 50 μm). The thickness of the layer below the holes was 484±5 nm, and below the metallic part of the grid, it was 158±5 nm. The samples were sterilized by 70% ethanol for 1 h, inserted into 24-well polystyrene multidishes (TPP, Switzerland; diameter 15 mm), seeded with human osteoblast-like MG 63 cells (5000 cells/cm^2) and incubated in 1.5 ml of the medium DMEM supplemented with 10% of foetal bovine serum (37°C, 5% of CO_2). As indicated by construction of growth curves, the growth dynamics of cells on all fullerene layers, followed during 5 days after seeding, was similar to the values found on standard cell culture substrates, represented by polystyrene dishes and microscopic glass coverslips. The size of cell spreading area, measured on day 3 after seeding, was also similar on all tested surfaces (range from 1580±180 to 1860±120 um2). Immunocytochemistry showed that the cells on all tested surfaces were able to form β1-integrin-containing focal adhesion plaques, β-actin cytoskeleton and to produce osteocalcin, a marker of osteogenic cell differentiation. These results are consistent with the earlier findings on non-cytotoxicity of non-solubilized fullerenes C60 [1] as well as on the improvement of cell spreading on fullerene-coated composites with carbon matrix reinforced with carbon fabrics [2]. Thus, it seems that fullerenes C60 layers act as good substrates for cell colonization, comparable to tissue culture polystyrene and glass, which could be due to their surface nanostructure mimicking the nanoarchitecture of natural extracellular matrix.

In the second set of experiments, single- or multi-walled carbon nanotubes were mixed with a terpolymer of polytetrafluoroethylene, polyvinyldifluoride and polypropylene to the concentration of 4%. On the nanotube-containing samples, the cells were well spread and contained fine beta-actin filament bundles (Fig. 1B), whereas the cells on the pure terpolymer were often rounded and clustered into aggregates. An enzyme-linked immunosorbent assay revealed that the cells on the material with single-walled carbon nanotubes contained a higher concentration of vinculin and talin, i.e. components of focal adhesion plaques (by 56% and 35%, respectively, compared to the pure terpolymer). However, the concentration of osteocalcin, a marker of osteogenic differentiation, was lower in cells on the terpolymer containing multi-walled nanotubes, which was probably due to more active proliferation of these cells (on day 7, they reached a 4.5 times higher population density than cells on the unmodified terpolymer). Adding single- or multi-walled nanotubes to the terpolymer did not increase the concentration of ICAM-1, a marker of immune activation, in MG 63 cells. The terpolymer-nanotube composites could be used for construction of three-dimensional porous scaffolds for bone tissue engineering. The nanotubes would create a nanopattern on the pore walls and improve the ingrowth of bone/forming cells inside the material. At the same time, the carbon component would improve mechanical properties of the material.

In the third set of experiments, nanocrystalline diamond (NCD) films were grown on (100) oriented silicon substrates (12 mm in diameter) by a microwave plasma-enhanced CVD method in the ellipsoidal cavity reactor. Prior

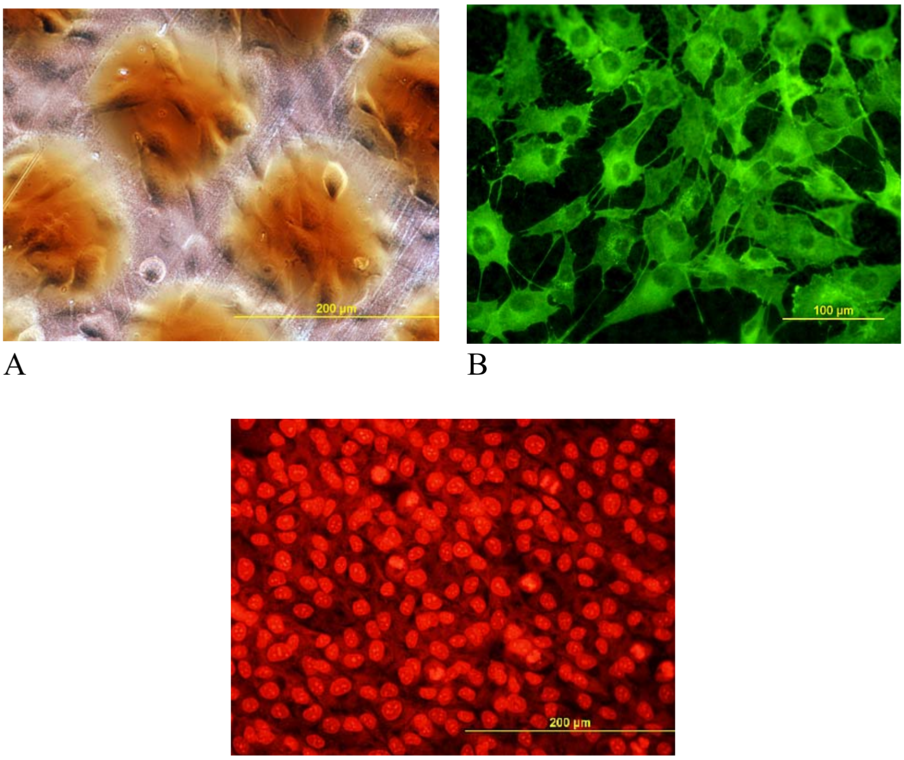

Fig. 1. Human osteoblast-like MG 63 cells in cultures on micropatterned layer of fullerenes C60 **(A)**, terpolymer of polytetrafluoroethylene, polyvinyldifluoride with 4 wt.% of multi-walled carbon nanotubes **(B)** and nanostructured diamond layer **(C)**. Microscope Olympus IX 50, digital camera DP 70, obj. 20. **A**: living cells on day 5 after seeding; **B**: immunofluorescence staining of β-actin, day 3 after seeding; **C**: propidium iodide staining of ethanol-fixed cells, day 7 after seeding.

to the deposition process, the silicon substrates were either polished to atomic flatness (root mean square, rms, about 1 nm) or mechanically lapped to the rms roughness up to 300 nm. Thus, the resulting NCD layers were either nanostructured (rms = 8.2 nm) or displayed a hierarchically organized micro- and nanostructure (rms of 301.0 nm and 7.6 nm, respectively) which resembled, at least to a certain degree, the architecture of natural tissues [4]. The deposited NCD films were treated in oxygen plasma to enhance the hydrophilic character of the diamond surface (water drop contact angle approx. 35°). On day 3 after seeding with MG 63, the cell number became significantly higher on nanostructured NCD films (7 680 ± 720 cells/cm^2) as well as on hierarchically micro- and nanostructured films (10 950 ± 1 350 cells/cm^2) than on control polystyrene culture dish (4050 ± 620 cells/cm^2). On day 7 after seeding, both nano- and micro-nano structured films were covered with confluent layers of

MG 63 cells (Fig. 1C) The XTT test showed that cells on both nanodiamond layers had significantly higher metabolic activity than on control polystyrene dish (approx. twice). Immunofluorescence staining revealed well developed talin-containing focal adhesion plaques, fine mesh-like beta-actin cytoskeleton and presence of considerable amount of osteopontin and osteocalcin, i.e. markers of osteogenic cell differentiation, in cells on both NCD films. Cell adhesion area was similar in cells growing on the nanodiamond substrate (2 744μm2 ± 133) and polystyrene dishes (2 742 ± 133 μm^2) but it was significantly larger in cells on hierarchically micro- and nanostructured diamond substrates (3 733 ± 179 μm^2). These results suggest that the nanocrystalline diamond films support well adhesion, growth and differentiation of osteogenic cells, which, together with their mechanical resistance, makes them suitable for coating bone implants (e.g., bone-anchoring parts of joint prostheses or bone replacements) in order to improve their integration with the surrounding bone tissue.

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Textiles as Scaffolds for Tissue Engineering

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Tissue engineering is the use of a combination of cells, engineering or tissue-matrix materials, and suitable biochemical factors to improve or replace biological functions. Tissue engineering is remarkably multidisciplinary, bringing together cell and molecular biologists, biochemists, engineers, pharmacologists, physicians, etc. So it means there is also place for textile engineers, who knows how special properties fibrous materials can have.

The production of fibrous scaffolds for tissue engineering is not new today, but there are new possibilities and new processes in the textile branch. Textile scaffolds are extremely versatile and therefore ideal, for encouraging cells to recreate the tissue geometry. They are easily adapted to meet the different cell requirements, for example by altering the fiber diameter and length or substituting the polymer. Scaffolds can be produced by “classical” textiles producing technologies: knitting, weaving, a production of nonwovens, braiding, embroidering or a combination of these techniques, see Fig.1.

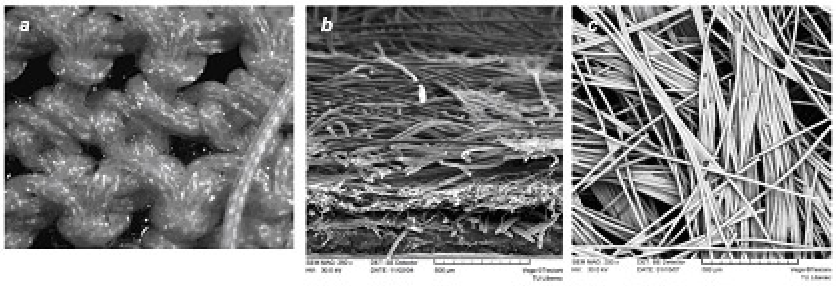

Fig. 1: Examples of fibrous scaffolds produced by knitting (a) and combination of nonwoven technologies spun-bond and melt-blown (b) and wet laid process (c).

There can be also used some of these modern techniques as for example electrospinning. Technology of electrospinning offers absolutely new possibilities for the small diameter of fiber, which are in the result material. In this case, there is talking about nanofibers (range of diameters is mostly between 100-300nm). From a physical point of view electrospinning resembles a tree with unusually manifold external morphology starting with its roots in a tiny surface layer of a polymer solution serving as one of a couple of electrodes, continuing with a stem represented by stable part of a jet. A whipping zone of the jet creates branches of the tree. Its fruits, i.e. nanofibres, are collected on one of electrodes connected to a high voltage source. The first principle of industrial production of nanofiber was developed and patented at Technical University of Liberec in 2003 and now the machines are sold by company Elmarco under the name Nanospider^{TM}.

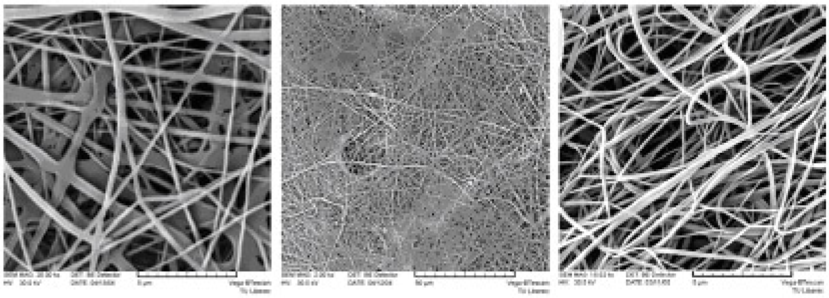

Fig. 2: Examples of electrospun nanofibrous materials from polyvinylalcohol and chitosan produced by technology so called Nanospider^{TM}.

Besides the production of nanofibrous layers – random orientation of fiber, circular and smooth fibers, relatively uniform distribution, there can be produce many of other nanofibrous materials at principles of electrospinning technology. There can be used liquid reservoir as a collector and then threads with high orientation of fibers are produced (see Fig 3a). If patterned collector as for example printed circuit is used, the result nanofibrous material is also patterned (see Fig. 3b). If there is used suitable mixture of polymer solutions for electrospinning, the result nanofibers can be porous after removing of one polymer (see Fig. 3c).There can be also used a combination of above mentioned technologies, for example combination of electrospinning and classical yarn production which results in yarn with nanofibrous surface (see Fig. 4a). And finally there is also possibility to combine textile materials and non-textile materials for improving result properties. One example can be seen at Fig. 4b and 4c, where knitted fabric is impregnated by foam.

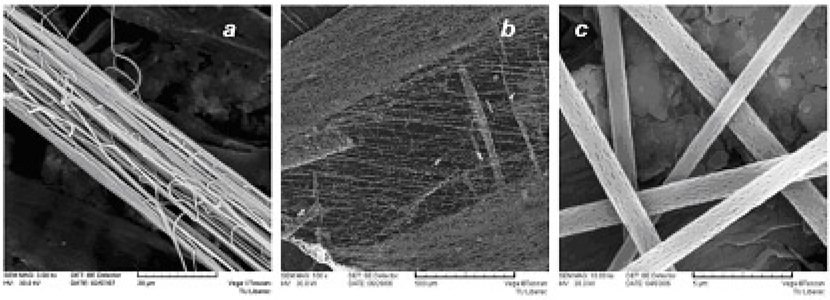

Fig. 3: Examples of nontraditional electrospun nanofibrous materials for special applications: electrospinning onto a level of liquid – production of linear nanofibrous thread (a), patterned nanofibrous material (b), porous nanofibers (c).

There can be also used a combination of above mentioned technologies, for example combination of electrospinning and classical yarn production which results in yarn with nanofibrous surface (see Fig. 4a). And finally there is also possibility to combine textile materials and non-textile materials for improving result properties. One example can be seen at Fig. 4b and 4c, where knitted fabric is impregnated by foam.

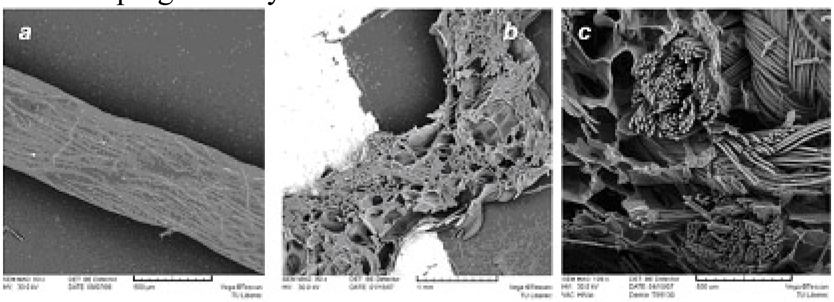

Fig. 4: Examples of composite scaffolds produced by combination of classical spinning (yarn production) and electrospinning = a yarn “covered by nanofibers” (a) and combination of knitted fabric and foam with interconnected pores.

Of course the materials, which are presented here, are only a part of the possibility how to use fibrous materials in the scaffold for tissue engineering production. The examples are presented mainly for introducing of versatility of textile materials. They can be design according a “customer” wish, it means there are many of textile’s types, they are porous and their pores are interconnected, they have relatively good mechanical properties and they are relatively three-dimensional. It is necessary to note, that all of materials presenting in this paper are produced from biocompatible and most of them from biodegradable materials (poly-glycolic-acid, poly-lactid-acid, chitosan, gelatine, pHEMA, polyvinylalcohol etc.), what is very important for their application in tissue engineering. The most of these material were already tested mainly in-vitro, but some of them also in-vivo and results are favorable.

Application of diamond-like films in medicine

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The unique properties of thin diamond layers make them perspective candidates for wide range of various applications – e.g. coatings for cutting tools, optics... Due to excellent biocompatibility and bioactivity of carbon resulting from the presence of this element in the human body, carbon coatings and powders obtained via various techniques appears to be a potential biomaterial. The studies of carbon films as coatings for implants in surgery are aimed at the investigations of biological resistance of implants, tests of corrosion resistance and measurements of mechanical properties. Properties of produced layers depend on method of synthesis, parameters of particular method and in the case of layers on the substrate which the layer is deposited. Carbon layers and powders can be obtained by the microwave and radio frequency plasma chemical vapor deposition (MW/RF PACVD). In these days various medical implants are covered by Diamond-like Carbon Coatings (DLC). DLC forms the diffuse barrier between implant and human organism. Diamond Powder Particles (DPP) is an extended surface of DLC. The research proved that diamond layers are biocompatible with living organisms.

Human bone-derived cells in cultures on composites with polysiloxane matrix reinforced with polyamide fabric and enriched with hydroxyapatite

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In this study we constructed 6 different composite materials for application in bone surgery using a polyamide fabric (Aramid, Hexcel, France) as reinforcement and polymethylsiloxane as the matrix. To increase the bioactivity, hydroxyapatite (HAp) particles with 10-100 μm or 10-40 μm in diameter were added. We tested the biocompatibility of the Aramid fabric and of the composites in vitro by seeding them with human osteoblast-like cells (line MG 63, initial density 21 000 cells/cm2) and culturing them in medium DMEM from 1 to 7 days. The cells on Aramid were in good condition as indicated by their morphology and high viability (>85%). Lower colonization of this material in comparison with the control polystyrene dish (TCPS) can be explained by the uneven surface morphology of the cloth, less favorable for cell attachment, rather than by the material's cytotoxicity.

The composite materials also supported cell adhesion and proliferation. As revealed by the immunofluorescence staining of beta-actin, the cells were of polygonal shape and well spread. Some of them were spindle-shaped and elongated in the direction of the reinforcing fibers. The cell number was significantly lower than on control because of the matrix hydrophobicity (water contact angle on pure siloxane matrix is ca 105 degrees) and high surface roughness. However, on the 3rd day after seeding, a confluent layer began to form similarly as on TCPS (Fig 1). Moreover, the viability of cells on day 7 after seeding was very high, above 90% on the basic composite (A) and on composites with HAp particles (D-F). The doubling time on samples A, D-F (<30h) is also comparable with the control (31.2h). These results suggest that the prepared composites are suitable for bone implant construction after further modifications of surface roughness and hydrophobicity.Subsequently we have tested the biocompatibility of the pure siloxane matrix as well as its combination with five different types of hydroxyapatite particles, differing in their origin (natural or synthetic), shape (spherical or irregular) and size (micro- and nano-size). The cell number was also in the case of these samples always lower than on the control polystyrene dish. On the first day after seeding the viability of all the matrices containing HAp particles was very low, only about 40%, which indicates on the possible cytotoxicity of HAp, probably due to high release of Ca ions. However, it should be also noted that this experiment requires further repetitions, as the viability of the MG63 cells on polystyrene culture dish on days 1 and 3 after seeding was also lower than usually, reaching only about 60-70%. On the 7th day after seeding the viability on all samples including control was very high, above 85%. On day 7 the overall cell number on the tested samples did not show any significant differences neither among the samples with various HAp particles, nor between pure siloxane matrix and matrices with HAp particles (Fig 2). However, these results need further verification as well as the biocompatibility of the HAp particles alone should be tested.

In general, the newly constructed composites seem to be very promising for potential use in bone regenerative surgery due to their excellent mechanical properties comparable with natural bone tissue. Nevertheless, the surface modifications, especially by HAp inclusions in the material, require further study to enhance the material biocompatibility and bioactivity.

Supported by the Grant Agency of the Czech Republic (grant No. 106/06/1576)

Informace o konferencích

SAMPE Asia 2008
11-13 February 2008, Shangri-la Hotel, Bangkok, Thailand
SAMPE Asia will be held at the Shangri-La Hotel in Bangkok, Thailand from February 12-13, 2008. Endorsed by the Thai Composites Association, this will be the first event organized by the Society for the Advancement of Material and Process Engineering (SAMPE) to be held in Thailand. "Coming at a time of tremendous growth and interest, we are excited to bring this program to Thailand," Gregg Balko, executive director of SAMPE said. "As a global organization, offering a technical program in this region is very important to our members and the advanced materials and composites industry. We are excited to present this conference and exhibition to this dynamic and growing marketplace.

SAMPE Asia will offer a comprehensive technical program featuring sessions and tutorials on topics concerning the industry. To compliment the technical program, SAMPE Asia will also feature an exhibition featuring tabletop and exhibit stands. SAMPE Asia will be chaired by Dr. Toshio Tanimoto, Shonan Institute of Technology, Japan; Dr. Klaus Drechsler, University of Stuttgart, Germany; and Mr. John Green, GSG Inc., USA.

Important Dates
Early registration: January 17, 2008

http://www.sampe.org/events/2008ASIA.aspx
SAMPEAsia@sampe.org

The British Composites Society
A Division of the Institute of Materials, Minerals and Mining

Living with Composites: Fire Resistance
27 February 2008, Begbroke Science Park, Oxford

Where composite materials are used in transport applications they need to perform safely under fire and accident conditions, especially where evacuation is difficult. Fire safety legislation has limited the use of composite material solutions in the transport sector. Technologies for fire resistant composite materials and protective coatings have advanced over recent years, but have not always been translated into the market. There is significant scope to exploit and improve technology in this area. Faraday Advance and the British Composites Society are organising this event with the following aims:

- To provide an overview of the existing technology
- To discuss and address the barriers and key needs for different transport sectors
- To create a forum for potential collaborations to develop and bring to market new and better fire resistant composite materials

Who should attend:

- Designers of boats, ships, aircraft, trains
- Builders of boats, ships, aircraft, trains
- Manufacturers of fire resistant products for the transport sector
- Researchers and academics involved in composites and/or fire resistance
- Those in regulatory bodies / involved in certification of materials and structures for the transport sector

An exciting line up of speakers will bring us news of the latest research, applications of products recently brought to market and the key needs and drivers for fire resistant composites in the transport sector.

http://www.bcompsoc.org.uk/events/fire_resistance_flyer.pdf

ISCM 2008

T4th International Symposium on
Manufacturing Technology for Composite Aircraft Structures
07 – 08 May 2008, Braunschweig, Germany
The ISCM 2008 aims to bring together international speakers, to present their work and views on the development and manufacturing of composite structures. In presentations will be analysed emerging issues, and will be offered the opportunity to discuss the state of the art of the fabrication technology that will be applied in near term aircraft development programmes.

At the ISCM 2006, hosted by NLR, 25 national and international speakers presented their views and work on a wide variation of themes such as thermoplastics, tape-laying, braiding, RTM and other liquid resin infusion processes. The positive feedback of the delegates the last times confirms the Symposium and we can be curious about the ISCM 2008.

The Call for papers is running until the 12th January 2008 and abstracts for the following topics can be submitted:

- Reduction of production lead time (e.g. simulation, rapid prototyping)
- Mass production of high performance composites (e.g. processes, tooling, preforming, materials)
- Production of very large composite structures (e.g. AFP, ATL, processing alternatives)
- Assembling and machining of composite components (e.g. tolerance management, machining, bonding)
- Integral or differential design approach (e.g. respective advantages and disadvantages)
- Material performance (e.g. toughness, fire smoke toxicity capability)
- Quality assurance (e.g. ultrasonic inspection, thermography)

Important Dates
Call for papers: January 12, 2008
Notification of presentation: February 17, 2008

http://www.iscm.eu
iscm@dlr.de

WESSEX INSTITUTE OF TECHNOLOGY
Advancing International Knowledge Transfer

HPSM 2008 - Fourth International Conference on High Performance Structures and Materials
13 - 15 May, 2008, The Algarve, Portugal
HPSM 2008 follows the success of the previous three conferences in the Series, held in Seville (Spain) in 2002; Ancona (Italy) in 2004; and Ostend (Belgium) in 2006. The Conference will continue to address issues involving advanced types of structures, particularly those based on new concepts or new materials. Contributions will highlight the latest developments in design, optimisation, manufacturing and experimentation within these areas.

The use of novel materials and new structural concepts nowadays is not restricted to highly technical areas like aerospace, aeronautical applications or the automotive industry, but also effects fields such as civil engineering and architecture as demonstrated in the proceedings of previous HPSM conferences.

Most high performance structures require the development of a generation of new materials, which can more easily resist a range of external stimuli or react in a non- conventional manner.
Particular emphasis will be placed on intelligent structures and materials as well as the application of computational methods for their modelling, control and management.

The list of topics gives an idea of the wide range of applications to be discussed during the Meeting. Contributions on topics not listed are also welcome if they fall within the scope of the Conference:

- Damage and fracture mechanics
- Composite materials and structures
- Optimal design
- Adhesion and adhesives
- Natural fibre composites
- Behaviour of FRP structures
- Material characterisation
- High performance materials
- High performance concretes
- Reliability of structures
- Polymers in engineering
- Emerging technologies
- Structural characterization
- Structural dynamics and impact behaviour
- Cellular structures
- Health monitoring
- Smart and functional materials
- Eco-materials
- Fire resistant materials
- Biomimetic structures and materials

http://www.wessex.ac.uk/hpsm2008rem2a.html
krobberts@wessex.ac.uk

ECCM13: 13th European Conference on Composite Materials
2 - 5 June 2008, Stockholm, Sweden
On behalf of the local organising committee of ECCM 13 KTH and SICOMP hereby invite you to attend the thirteenth European Conference on Composite Materials (ECCM 13) to be held in Stockholm, Sweden from June 2nd to 5th, 2008.
ECCM is Europe's leading conference on composite materials. As such it will follow the long tradition of the ECCM conference series with a wide scope of technical topics in composite materials research. The conference attracts internationally renowned scientists, engineers and designers in the fi eld of composites.

Conference Topics:

- Applications
- Bio-based composites
- Biomimetic composites
- Carbon and ceramic matrix composites
- Damage and fracture
- Durability and ageing
- Experimental techniques
- Fibres, matrices and interfaces

- Health monitoring
- Infrastructure
- Interlaminar reinforcements
- Interfaces and interphases
- Joint and bearing behaviour
- Life cycle analysis and sustainability
- Low cost technologies
- Mechanical and physical properties
- Metal matrix composites
- Multifunctional composites
- Multiscale modelling
- Nanocomposites
- NDE technologies
- Probabilistic approaches and design
- Processing and manufacturing technologies
- Repair technologies
- Recycling
- Sandwich technologies
- Standardisation
- Structural design
- Textile composites
- Wood and paper

Please note that the conference is not limited to the above topics. Ideas on other topics or special Micro-symposia, which you think are suitable for the conference, can be forwarded to the organisers by e-mail. High-quality papers will be guaranteed through a thorough review process, following the tradition of ECCM. The review will consider originality, relevance, timeliness and signifi cance of the proposed papers. In addition, a number of Keynote Lecturers will be invited.

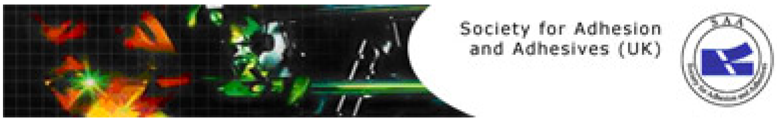
Important Dates
Deadline for Submission of Manuscript and Early Bird registration
March 31, 2008
http://eccm13.sicomp.se
eccm13@sicomp.se

9th International Conference on Flow Processes in Composite Materials
8 - 10 July 2008, Montreal, Canada
The 9th International Conference on Flow Processes in Composite Materials (FPCM-9) will be held from July 7th to 9th 2008, in Montreal, Quebec (Canada). This conference is the ninth in a series devoted to the manufacturing of polymer matrix composites. Each conference has attracted papers of high quality and provided a forum for discussion between academia and industry.

Hosted in 2008 by École Polytechnique de Montréal, Canada, the conference will feature state-of-the-art achievements in composite manufacturing and liquid composite moulding with a particular emphasis on aerospace and automotive applications

One of the main goals is to help bridge the gap between theory and practice. Lecturers from academia and industry will discuss the latest scientific results on flow processes and illustrate through specific examples applications of liquid composite moulding to the manufacturing of high performance composites.

http://cchp.meca.polymtl.ca/fpcm9
trochu@polymtl.ca



Tenth International Conference on the Science and Technology of Adhesion and Adhesives
3 - 5 September 2008, St Catherine's College, Oxford, UK
Following the success of the Euradh conferences at Karlsruhe in 1992, Mulhouse in 1994, Cambridge in 1996, Garmisch-Partenkirchen in 1998, Lyon in 2000, Glasgow in 2002 and Freiburg im Breisgau in 2004, Euradh 2008 will take place in Oxford from 03 - 05 September 2008. Euradh 2008 will also encompass Adhesion '08, the 10^{th} in the series of international conferences held, since 1980 on a triennial basis in the UK.

The scientific committee, which is drawn from specialists well-known to the international adhesion community and is co-chaired by RA Chivers (UK), E Papon (France) and W Possart (Germany), now requests papers on any of these aspects of the science and technology of adhesion and adhesives:

- Fundamental aspects of adhesion
- The science and technology of surfaces
- Bio-adhesion and cellular adhesion
- Properties of surfaces
- Engineering aspects of adhesion and engineering applications
- Super-molecule structures used in adhesives
- Advances in adhesive materials
- Environmental and ecological aspects
- Mechanical properties of bonded joints including their durability
- Quality procedures, testing and standardisation
- Innovative designs and applications
- Industrial aspects

http:/www.uksaa.org
malcolm.bowditch@ntlworld.com

TEXCOMP 2008 - The 9th International Conference on Textile Composites
13 - 15 October 2008, University of Delaware, USA
The goal of TEXCOMP is to promote knowledge in the field of textile composites throughout the world. By bringing together scientists and engineers active in a variety of disciplines, the conference provides a dedicated forum for discussions and reports on recent advances in textiles and their composites. This is the ninth conference in this series, which started in 1992 in Leuven, Belgium, chaired by Professor Ignaas Verpoest. The conference has rotated between Europe, Asia and North America in the intervening years. TEXCOMP has an international audience, attracting world leading researchers in composite materials. The scope of the conference includes the following areas:

- Mechanical design and modelling
- Advanced manufacturing processes
- Net-shape 3D textile preforms
- Nano-fibres and composites
- Elastic and failure behaviour
- Process simulation and control
- Textile modelling
- Industrial applications and case studies

Important Dates
Early Bird Registration - Deadline April 30, 2008

http://www.ccm.udel.edu/texcomp9
hamed@udel.edu

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- Disertace, výsledky grantových projektů vypracovaných v ÚSMH (řada AB)

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jsou (*.doc, *.xls, *.ptt, *.bmp, *.pcx, *.tif, *.jpg, *.gif). Ilustrace jsou číslovány v pořadí tak, jak je o nich referováno. Popis nesmí být umístěn přímo v obrázku, soupis všech popisů musí být na samostatné stránce. U popisu obrázku je třeba uvést jeho požadovanou velikost v textu. Redakce přijímá rovněž barevné ilustrace (min. 1200 dpi, max. velikost vytištěného obrázku je 24x16 cm). Barevné ilustrace jsou tištěny jednostranně a umístěny na konci článku jako příloha. Náklady na tisk těchto barevných příloh hradí autor. (2000 Kč za stranu). Proměnné, konstanty aj. symboly v matematických rovnicích a odkazy na ně v textu je třeba psát výhradně v editorech rovnic MS Equation Editor nebo MathType. Všechny použité symboly musí být vysvětleny v textu nebo v seznamu symbolů.

Odkazy na literaturu v textu musí být ve formě (autor, rok), např., (Balik, 2001), (Rudajev et al., 2002). Soupis všech odkazů v abecedním pořadí musí být na samotné stránce ve tvaru:
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např. Mierzejewski, M., Korzak, F. and Kaczalek, M.: 2002, Geodynamic research of recent movements in the Karkonosze Mts, Acta Montana ser.A., 15(126), 56-78

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- Extended essays, PhD dissertations or results of grant projects elaborated in IRSM (series AB)

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Submissions:
Acta Montana accepts original papers in English concerning all aspects of mentioned disciplines. Authors should submit three hard copies of their contribution and identical text file in MS Word (any version) and in case of need other files (figures, tables etc.) by e-mail, on 3.5" floppy disc, ZIP or CD-ROM. The Editorial Board on the basis of reviews of at least two referees makes the decision upon their publication. Author first named will receive one volume of Acta Montana and twenty reprints free of charge.

The manuscript must contain:
Title, full names of all authors, their affiliations and addresses including phone number, fax number and e-mail address, abstract, keywords and main body of paper (all in English).

It can be included:
Tables at max. size 24x16 cm and min. font size 9 pt, in text or on separate pages. Tables must be written really as tables (in columns), not as text (in rows). Captions of all tables must be on separate page.
Figures: Black and white photographs, drawing or maps in good

quality (min. 600 dpi) are acceptable. Charts and diagrams must be in black and white, description of axes must be at sufficient size in due to possibility of reducing. Figures may be placed in text or as separate files. Only permitted formats of these files are (*.doc, *.xls, *.ptt, *.bmp, *.pcx, *.tif, *.jpg, *.gif). Figures are to be referred as Fig. Arabic numeral and should be numbered consecutively, according to their sequence in the text. Caption must no be in placed in the figure area. List of captions of all figures must be on the separate page. Required size of the pictures in the text must be denoted at the list of captions. Color illustrations are tolerable (min. 1200 dpi), but at author's expense 75 EUR per 1 page A4). These pages, (pressed on one side) will be placed on end of the paper as appendix. Variables, constants and other symbols in mathematical functions and also in the text are accepted written exclusively at MS Equation Editor or MS MathType. All used symbols must be explained in text or in the List of symbols.

References quoted in the text must be in form (author, year), e.g., (Balik, 2001), (Rudajev et al., 2002). All references should be listed together at the end of the paper in alphabetic order as:
First name, signatures of surnames, (names of other authors except last) and (First name, signatures of surnames of last author): year, title, journal, number, pages

e.g. Mierzejewski, M., Korzak, F. and Kaczalek, M.: 2002, Geodynamic research of recent movements in the Karkonosze Mts, Acta Montana ser.A., 15(126), 56-78

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