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Book of abstracts



Session	Paper title and abstract
S1: 09 ⁴⁰ -10 ⁰⁰	<p data-bbox="725 172 1704 201" style="text-align: center;"><i>Reversion treatments to improve fatigue and formability of metastable stainless steels</i></p> <p data-bbox="972 220 1458 248" style="text-align: center;">G. Fargas, A. Zapata and A. Mateo (UPC)</p> <p data-bbox="344 292 2033 384">AISI 301LN is a metastable austenitic stainless steel currently used in applications where severe forming operations are required, such as automotive bodies, due to its excellent combination of high strength and ductility. Plastic deformation at room temperature, for example by cold rolling, induces martensite and, as a result, leads to important improvements on yield strength, but reducing the ductility.</p> <p data-bbox="344 392 2033 485">Grain refinement is the only method that allows improving both strength and ductility simultaneously. Several researchers have demonstrated that fine grain 301LN may be obtained by heat treatment after cold rolling. This heat treatment is called reversion because provokes the reversion of strain induced martensite to austenite.</p> <p data-bbox="344 493 2033 585">In the present work, 301LN sheets previously subjected to 20% of cold rolling reduction were treated and a fine grain austenitic microstructure was obtained. Mechanical properties, including fatigue limit and formability, were determined and compared with those corresponding to the steel both before and after the cold rolling.</p>
S1: 10 ⁰⁰ -10 ²⁰	<p data-bbox="533 624 1892 652" style="text-align: center;"><i>Time diffusivity estimations in press hardening and welding processes with quenching and partitioning heat treatments</i></p> <p data-bbox="1099 671 1326 700" style="text-align: center;">E. Vuorinen (LTU)</p> <p data-bbox="344 743 2033 868">The quenching and partitioning heat treatment process has been used in press hardening and welding processes of advanced high strength steels with the purpose to increase the phase transformation rate. Different quenching and partitioning temperatures and times were used in order to optimize microstructure and mechanical properties. Hardness measurements, tensile testing, light microscopy, scanning electron microscopy and XRD-measurements have been used in order to characterize the materials.</p> <p data-bbox="344 876 2033 968">The results show that calculations of the time diffusivity during the partitioning period can be used as a tool in predicting the final hardness of the steels. In combination with knowledge of the microstructure can these calculations be used in optimization of the heat treatment process in welding and press hardening.</p>
S1: 10 ²⁰ -10 ⁴⁰	<p data-bbox="837 1007 1592 1035" style="text-align: center;"><i>Study of Alpha Case Depth in Ti-6Al-2Sn-4Zr-2Mo and Ti-6Al-4V</i></p> <p data-bbox="866 1054 1563 1083" style="text-align: center;">R. Gaddam, <u>B. Sefer</u>, R. Pederson, M.-L. Antti (LTU, GKN)</p> <p data-bbox="344 1126 2033 1485">Titanium alloys, mostly Ti-6Al-2Sn-4Zr-2Mo (Ti-6242) and Ti-6Al-4V (Ti-64) are used in aero engine applications, because they possess high specific strength. The future concept in designing aircraft engines results in higher pressure, which increases the efficiency of aircraft engines by achieving high thrust and lowering the fuel consumption. Nevertheless, higher pressure in the engine means increase of service temperature. These conditions enforce new requirements on the materials used for manufacturing the engine components (compressors). Ti-6242 is mostly used in compressors where the service temperature is in the range of 400-450°C. It is well known that titanium alloys above 480°C for longer service time have tendency to form a hard and brittle oxygen stabilized surface layer (α-case). This layer has impact on the mechanical properties of the surface, by lowering the tensile ductility and the fatigue resistance. Factors that contribute for growth of α-case are: presence of oxygen, exposure time, temperature and pressure. In order to extend the service temperature of titanium alloys, it is required to understand the formation of α-case at high temperatures for long exposure times. In the present study, isothermal oxidation experiments in air were performed on forged Ti-6242 alloy at 500°C and 593°C up to 500 hours. Similar studies were also performed on Ti-64 sheet at 593°C and 700°C. Alpha case depths for both alloys were quantified using metallography techniques and compared.</p>

S2: 11 ⁰⁰ -11 ²⁰	<p style="text-align: center;"><i>Influence of solid/liquid interface temperature on the final microstructure of dissimilar Fe/Fe-Mn-C steel joints</i></p> <p style="text-align: center;">J. Zollinger, M. Escot, D. Daloz, B. Rouat and Th. Dupuy (UL, ArcelorMittal)</p> <p>Welding of very dissimilar steel grades often lead to poor mechanical properties compared to a homogeneous weld joint. When joining a low-alloyed steel (LAS) with high manganese steel (HMS) by resistance welding, the fracture is located at the weld pool / LAS interface. A thorough study of the interface between the liquid and the LAS was carried out using quenching after holding the liquid HMS / solid LAS interface in a thermal gradient. The different interfaces obtained were characterized by optical and electronic microscopy techniques: EDX, EDSB and EPMA.</p> <p>Depending on the holding time and due to carbon and manganese diffusion in the LAS, solute-driven melting lead to a continuous change of the interface temperature. This change leads to different microstructures and morphologies that are similar to those observed in resistance welding. The analysis shows that when the interface temperature is below the peritectic temperature, the interface is unstable and composed of ϵ-martensite; whereas at interface temperature above the peritectic temperature, the interface is smooth and martensite-free.</p>
S2: 11 ²⁰ -11 ⁴⁰	<p style="text-align: center;"><i>Effects of some electrical parameters on the efficiency of the Plasma Electrolytic Oxidation of aluminium alloys</i></p> <p style="text-align: center;">J. Martin, A. Nominé, I. Shchedrina, A.G. Rakoch, G. Henrion, T. Czerwiec, T. Belmonte (UL, MISIS)</p> <p>The Plasma Electrolytic Oxidation (PEO), also known as Micro-Arc Oxidation (MAO) is a particular electrochemical process to produce protective oxide ceramic coatings on light-weight metals (such as Al, Mg, Zr, Ti and their alloys). Growth of the oxide layer takes place at potentials above the dielectric breakdown voltage of the insulating oxide surface layer leading to the development of large numbers of short-lived micro-discharges (atmospheric micro-plasma in liquid medium) which move randomly over the processed surface. The resulting coating exhibits improved surface performances in terms of hardness, wear protection and corrosion resistance. Associated with the use of environmentally friendly diluted alkaline electrolytes, PEO process gains a growing interest in various industrial domains (transport, energy, medicine) to replace conventional chromic or hard anodizing.</p> <p>Despite the considerable interest in this process, there is still no clear understanding of the underlying discharge mechanisms that make possible metal oxidation up to hundreds of μm through the ceramic layer. Moreover, no clear relationship has been established between the process parameters and the resulting layer characteristics.</p> <p>Using an AC pulse bipolar current generator to supply the sample to be processed, the aim of the present communication is to give new insight into the influence of some electrical parameters on the efficiency of the plasma electrolytic oxidation of Al2214 aluminum alloy. A particular attention was paid to the current density (from 10 to 80 $\text{A}\cdot\text{dm}^{-2}$) and the current pulse frequency (from 100 to 900 Hz). Micro-discharges are characterized during the process by means of fast video imaging (up to 125000 frames/s) with a time and a space resolution of 8 μs and 0.017 mm^2, respectively. Correlations are established between the micro-discharges characteristics (surface density, lifetime and size) and the elaborated oxide layers (morphology, growth rate, roughness).</p> <p>Results clearly point out the influence of the current density and the current pulse frequency on the process. Coating growth rate is improved with the combination of the highest current density and the highest current pulse frequency. Within these specific electrical conditions it is observed that the detrimental effects of strong (long-duration up to 0.3 ms and large size up to 0.5 mm^2) micro-discharges are minimized.</p>

S2: 11 ⁴⁰ -12 ⁰⁰	<p style="text-align: center;"><i>Analysis of Changing Magnetic Properties when Milling Steel 1.7225</i></p> <p style="text-align: center;">K. Trapp, J. Ratcovich, D. Bähre (Saarland University)</p> <p>Ferromagnetic materials may change their magnetic fields due to machining. This could lead to a contamination of the work piece surface due to attracted particles and influence further processing and application. A better understanding of the mechanisms in milling processes leading to magnetic fields is a prerequisite to meet high demands on the cleanliness of the machined parts and the quality of the assemblies. In this paper, the mechanisms which lead to magnetism occurring in milling processes of steel 1.7225 are discussed. In the course of the test series, process parameters of the milling operation have been varied and resulting surface changes and magnetic characteristics have been analysed. The changing magnetic properties are measured by means of Hall Effect sensor and by Atomic Force Microscopy. Interdependencies between process parameters and work piece characteristics are described.</p> <p>With a better understanding of the mechanism it will be possible to improve the machining process and thus enhance the cleanliness of the workpiece.</p>
S2: 12 ⁰⁰ -12 ²⁰	<p style="text-align: center;"><i>Production and characterization of MWNT/Ni composites</i></p> <p style="text-align: center;">S. Suarez, <u>F. Soldera</u>, F. Lasserre, C. Gonzalez Oliver, F. Mücklich (Saarland University)</p> <p>MWNT-reinforced Ni matrix composites were successfully manufactured by a colloidal mixing process. In this technique, a solvent dispersion of MWNT was mixed with the metallic powder and then densified by two different methods, namely pressureless sintering and hot uniaxial pressing. Deformation by high pressure torsion was also applied to some of the composites. Grain structure and distribution of the reinforcement was characterized by scanning and transmission electron microscopy, focused ion beam tomography and X-ray diffraction. The thermomechanical behaviour of the composites was studied in the range between 50°C and 1050°C and compared to that of pure Ni. The results showed an active interaction between the MWNT and the Ni matrix by reducing the thermal expansion coefficient (CTE) up to 24% to that of pure Ni between 50°C and 400°C. This reduction was due to the low intrinsic CTE of the nanotubes and the strong interfacial interaction between the matrix and the reinforcement. Mechanical properties of the composites were determined by micro-indentation. We observed a strong influence of the amount of MWNT in the composite of the final grain size of the matrix material. Our results highlight the tailoring and enhancement of mechanical properties by controlling the composite microstructure.</p>
S3: 14 ⁰⁰ -14 ²⁰	<p style="text-align: center;"><i>Comparative study of double walled carbon nanotubes exposed to shock wave (dynamic) vs static compression</i></p> <p style="text-align: center;">M. Mases, V. V. Milyavskiy, J. Waldbock, M. Dossot, X. Devaux, E. McRae and A. V. Soldatov (LTU, IIHT RAS, UL)</p> <p>We present the study of double walled carbon nanotubes (DWNTs) after application of shock wave (dynamic) compression in a recovery assembly. In the different shock wave experiments the pressure was ramped to a certain level (14, 19, 26 and 36 GPa) with a new CNT sample but always from the same source batch. The recovered samples were characterized by Raman, XPS and HRTEM revealing outer wall disruption along with unzipping and shortening of the CNTs. The carbon nanotube destruction due to temperature increase is minor compared to the effect of the shock wave for the short exposure times in the experiment. Structural damage of the CNTs increases with the shock pressure. Simultaneously, the Raman data exhibit a gradual increase of D/G-band intensity ratio. On the contrary, recent experiments in a diamond anvil cell (DAC) demonstrate high structural stability of DWCNTs exposed to a static pressure of 35 GPa. The ID/IG-ratio after exposure to static pressure starts to increase only after a clear threshold corresponding to the tubes collapse pressure. Remarkably, there are indications that the largest diameter CNTs were destroyed (RBM signal disappeared) by application of the highest shock contrary to the behavior of DWNTs at comparable static pressures. Along with the nature of the applied pressure, we discuss other possible reasons which may have caused such an effect.</p>

S3: 14 ²⁰ -14 ⁴⁰	<p style="text-align: center;"><i>Chemistry, microstructure and properties of Au/yttria stabilized zirconia nanocomposite films</i></p> <p style="text-align: center;">D. Horwat (UL)</p> <p>Microstructural and chemical analyses are routine characterizations in the field of materials science. Information at the molecular or atomic scales (coordination, oxidation states) is particularly relevant to understand the physical and chemical properties of materials. The far out of thermodynamic equilibrium conditions associated to the condensation process of physical vapour (PVD) deposition methods can lead to very specific local chemical and microstructural states in thin films. This is a direct way to modify the properties of the synthesized thin films. In this communication we treat the case of gold/yttria stabilized zirconia nanocomposite thin films relevant for the fields of low friction, plasmonics and catalysis. We use X-ray absorption near edge structure (XANES) in combination to transmission electron microscopy (TEM), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), optical and electrical characterizations to investigate the properties/microstructure of magnetron sputtered thin films in relation to the local chemical state of their constitutive elements. A special attention paid to the oxidation state of the metal atoms in relation to the size of the nanoparticles. The size is controlled by the synthesis parameters and the gold content. The influence of the local state on the plasmonic, electrical and catalytic properties is demonstrated.</p>
S3: 14 ⁴⁰ -15 ⁰⁰	<p style="text-align: center;"><i>Adsorption Characteristics of Nanocrystals Isolated from Bioresidues: Effect of pH and Surface Charge</i></p> <p style="text-align: center;">P. Liu, K. Oksman and A. P. Mathew (LTU)</p> <p>Cellulose nanocrystals and chitin nanocrystals respectively were isolated from bioresidues viz, sludge from special cellulose production and crab shell waste using acid hydrolysis. The atomic force microscopy images showed that the diameter of CNWs ranged from 10 - 20 nm and chitin whiskers ranged from 20 - 40 nm. Thermal degradation temperatures of nanocellulose and nanochitin whiskers were found to be 186 °C and 234 °C respectively. The crystallinity index of CNWs was 72.3 % while that of chitin nanowhiskers was as high as 87.2 %. Conductivity titration and zeta sizer studies proved the high surface charge of both CNWs and chitin nanowhiskers. Besides, chitin nanowhiskers are positively surface charged at acidic pH and negatively surface charged at alkaline pH. ICP-MS (inductively coupled plasma mass spectrometry) and XPS (X-ray photoelectron spectroscopy) will be conducted to evaluate the adsorption potential of CNWs and chitin nanowhiskers to heavy metal ions as functions of pH and surface charge.</p>
S3: 15 ⁰⁰ -15 ²⁰	<p style="text-align: center;"><i>Melt spinning of cellulose acetate butyrate (CAB) nanocomposite fibers reinforced by cellulose nanowhiskers (CNW)</i></p> <p style="text-align: center;">S. Hooshmand, S.-W. Cho, M. Skrifvars, A. Mathew, K. Oksman (LTU, UB)</p> <p>Bio-based continuous fibers were processed by melt spinning of cellulose acetate butyrate (CAB) and cellulose nanowhiskers (CNW) as well as environmental friendly plasticizer, triethyl citrate (TEC). Homogeneous dispersion of the CNW in CAB was achieved by solvent exchange to ethanol using sol-gel process. The appropriate amounts of well dispersed CNW organo-gel (2 and 10 wt%) as well as 15 wt% TEC were compounded with the dissolved CAB in ethanol followed by magnetic stirring, solution casting and grinding. Melt spinning of compounded CAB/TEC and CAB/TEC/CNW were carried out using a twin-screw micro extruder in continuous mode to decrease the residence time of materials and avoid thermal degradation. Afterwards, the fibers were solid-state drawn to enhance the mechanical properties. The addition of the CNW restricted the drawability of the fibers to a factor of 1.5. The tensile test data showed that 2 wt% CNW had no noticeable effect on modulus and tensile strength of the fibers while 10 wt% CNW increased the modulus and tensile strength by 58% and 36% respectively. Drawing, in general, provided greater stiffness and strength but sacrificed the ductility of the fibers. The microscopy studies showed that the fiber diameters were in the range of 350-450 µm for as-spun fibers and 300-350 µm for drawn fibers and no defect and increased surface roughness could be detected on the surface of the both as-spun and drawn composite fibers. Furthermore, The thermal properties, viscoelastic behavior as well as crystallinity properties of the fibers were characterized by TGA, DMTA and XRD.</p>

S3: 15 ²⁰ -15 ⁴⁰	<p style="text-align: center;"><i>Elaboration of monolithic organic aerogel from low molecular weight organogel: Towards thermal insulators</i></p> <p style="text-align: center;">S. Son, D. Barth, F. Allix, G. Pickaert, Y. Jeannot, V. Felix, A. Degiovanni, B. Jamart-Grégoire (UL)</p> <p>A family of low molecular weight organogels obtained from amino acid derivatives via an easy and inexpensive way has been studied. The supramolecular organization of gelator molecules has been elucidated by using X-ray diffraction, NMR and IR spectroscopies. The removal of the solvent by supercritical CO₂ drying process leads to the corresponding aerogel in a monolithic form. This new material possesses a very low density and a high specific surface. Moreover, regarding the aprotic character of the solvent which contribute to the gel formation, the corresponding aerogel possesses a very important hydrophobic property. More interestingly and newly, these new organic aerogels can be handled with care without cracking. This property let us to undertake thermal conductivity measurement and conclude that this new material could be useful for thermal insulation.</p>
S4: 16 ²⁰ -16 ⁴⁰	<p style="text-align: center;"><i>Biofunctionalization of CoCr surfaces with bioactive molecules to improve endothelization of cardiovascular implants</i></p> <p style="text-align: center;">M. I. Castellanos, J. C. Rodríguez-Cabello, C. Mas-Moruno, F. J. Gil, J. M. Manero, <u>M. Pegueroles</u> (UPC, CIBER-BBN)</p> <p>Objectives: To improve cardiovascular stent success, biomaterial surfaces are designated to modulate endothelial cells (EC) response, in order to prevent atherosclerosis, restenosis and thrombosis diseases. The attachment of biofunctional molecules on CoCr stent surfaces is a very promising strategy to enhance EC adhesion and growth. We aimed to obtain a new family of functionalized CoCr alloy surfaces by covalently-anchoring REDV elastin-like polymer or cell adhesive motifs.</p> <p>Materials and Methods: CoCr alloy (ASTM F90) discs were treated with plasma (PL) and etched with 5M NaOH 2h (NaOH) previous to silanization with 3-chloropropyltriethoxysilane (PL+CPTES and NaOH+CPTES) and functionalized with REDV elastin-like polymer and dimeric peptides (containing RGD, REDV, YIGSR). SEM, interferometry, contact angle, zeta potential, XPS and ToF-SIMS were used to determine physico-chemical surface properties at each procedure step. Biofunctional molecules quantification and HUVEC cell studies were performed by means of AFM, QCM-D, FITC, and fluorescence microscopy.</p> <p>Results and discussion: ToF-SIMS and XPS results confirmed the immobilization of the bioactive molecules on CoCr surfaces. Surface chemistry by XPS, detected the activation of OH- groups on the treated surfaces. REDV elastin-like polymer increased number of adhered HUVEC cells and spreading of cells on the different CoCr surface finishes. Peptides physisorption and functionalization generally increased cell adhesion. REDV series presented higher cell spreading compared to YIGSR.</p> <p>Conclusions: Bioactive molecules adhesion on the treated surfaces increased the number of adhered EC cells and cell spreading. Treatments performed to activate the surfaces affect biopolymer and cell adhesive peptides adsorption and conformation. Covalent immobilization on CoCr surfaces of different cell adhesive motifs represents an innovative technique to improve stents endothelization.</p>
S4: 16 ⁴⁰ -17 ⁰⁰	<p style="text-align: center;"><i>Synthesis and characterization calcium phosphate foams with controlled drug release properties for bone regeneration</i></p> <p style="text-align: center;">D. Pastorino, C. Canal, M.P. Ginebra (UPC, CIBER-BBN)</p> <p>Calcium Phosphate Cements (CPCs) are used as synthetic bone grafts and have been shown to have high potential for bone regeneration, and as local drug delivery systems due to different properties, among which their nano- and microporosity. However, this intrinsic porosity of CPCs does not always allow the drug to be fully released, so introduction of macropores in CPCs emerges as an interesting alternative. Calcium Phosphate Foams (CPF) can be obtained by foaming the liquid phase of CPCs, and their macroporosity fulfills the requirements of pore size and interconnectivity that are relevant for bone regeneration. Moreover, their open macroporosity is expected to strongly modify the drug release kinetics.</p> <p>In this work antibiotic-eluting self-setting CPF are developed and characterized. To this end, a widely-used antibiotic in periodontal diseases (Doxycycline hyclate) is added to the calcium phosphate reactants before preparation for obtaining of a solid hydroxyapatite foam. The effect of the antibiotic addition on the setting reaction and structural parameters of the foam is studied, and the antibiotic release profile is determined for</p>

	<p>different antibiotic concentrations. Results show that CPFs are able to release much higher drug percentages than their unfoamed counterparts (five-fold), and that antibiotic release is sustained for longer periods of time. It has been observed that different amounts of the antibiotic lead to important structural effects in the Calcium Phosphate foam architecture, such as increased pore interconnectivity, which opens interesting prospects for the materials.</p>
S4: 17 ⁰⁰ -17 ²⁰	<p style="text-align: center;"><i>Laser Interference Metallurgy - a Bio Inspired Tool to Create Unique and High Performing Surfaces</i></p> <p style="text-align: center;">C. Gachot (Saarland University)</p> <p>Tailoring of microstructures and surface functionalization are key goals in the surface technology of materials. Starting from nature we are able to learn from many examples, that lateral and periodic microstructures show superior composite effects. The bone structure for instance, consisting of tough collagen and stiff mineral, combines the superior advantages of both properties by downsizing the dimensions of the components in the micro/nano range. As a consequence, the stiffness does not increase at the expense of toughness. From the technological point of view, we have to supply structuring techniques, which are able to create such lateral periodic microstructures with relevant time efficiency and geometrical precision in order to tailor reliable properties on macroscopic surfaces. A new technology, allowing a quick and geometrically precise as well as direct structuring of ordered periodic microstructures at material surfaces, is the "Laser Interference Metallurgy". Basically, a high power laser pulse is split into several coherent sub beams which interfere in a periodic pattern on the surface of the sample. The shape and the dimensions of the interference pattern as well as its periodicity can be controlled by the angular and the intensity arrangement of the sub beams. Due to the high and localized periodic intensity distribution of the nanosecond laser pulse a precise redesign of the surface microstructure in terms of recrystallization, phase arrangement, texture, residual stresses or topography is possible. Various examples shall be presented in order to demonstrate the versatility of this technique for unique surface architectures and controlled properties such as friction and wear.</p>
S4: 17 ²⁰ -17 ⁴⁰	<p style="text-align: center;"><i>ATZ via infiltration method: mechanical properties, aging resistance and wear behavior</i></p> <p style="text-align: center;">E. Camposilvan, F. G. Marro, A. Mestra and M. Anglada (UPC)</p> <p>Zirconia-alumina composites represent nowadays the most interesting advanced ceramics for biomedical applications when it comes to joint replacement and dental implants. The advantages offered by these materials derive from the combination of high hardness, wear resistance and absence of aging offered by alumina with large mechanical strength and moderate fracture toughness of tetragonal zirconia. Furthermore, both oxides have been proven to be biocompatible and atoxic in their bulk state, so the design of tuned composites and related processes is of utmost interest. The research around these topics led in the last 20 years to the development of either zirconia- or alumina-based materials with improved characteristics.</p> <p>Alumina-toughened zirconia (ATZ) is prepared in this study by the infiltration method, obtaining tailored composites in a simple way at relatively low sintering temperature. Zirconia machinable porous blanks are first infiltrated with aluminum nitrate solution, then dried, thermally treated and sintered. Microstructural and aging properties are evaluated and compared with 3Y-TZP reference material, demonstrating superior aging behavior for the composites. In the same way, mechanical properties and wear behavior are studied, resulting in better performances in terms of hardness, indentation fracture toughness and wear resistance for ATZ. Finally, a possible mechanism to explain the differences observed is proposed and discussed.</p>

S5: 09 ⁰⁰ -09 ²⁰	<p style="text-align: center;"><i>Contact fatigue of ceramic-coated hardmetals</i></p> <p style="text-align: center;">J.Yang, C.Botero, N.Cornu, G.Ramírez, A.Mestra, L. Llanes (UPC)</p> <p>In this investigation spherical indentation tests are used for assessing the contact fatigue behavior of a fine-grained WC-Co cemented carbide coated with two distinct ceramic films: AlCrN and WC/C, either as monolayers or bilayers. Emphasis is placed on determining the indentation stress affiliated to the emergence of circular cracks at the coating, event found to be critical for the coated systems under consideration. Results indicate that coated cemented carbides are found to be fatigue susceptible under contact loading, although effective fatigue sensitivity and failure scenario are discerned to be dependent on ceramic nature (crystalline/amorphous) and assemblage (mono- or bilayer) of the coatings.</p>
S5: 09 ²⁰ -09 ⁴⁰	<p style="text-align: center;"><i>Mechanical and Electrical properties of 3Y-TZP/CNT composites</i></p> <p style="text-align: center;">L. Melk, J. J. R. Rovira, F. G. Marro, M. Anglada (UPC, LTU)</p> <p>There has been a considerable concern in developing zirconia based composites for high fracture toughness and strength for structural applications. Nowadays, there is more interest in using carbon nanotubes (CNT) as reinforcements in zirconia composites. This is due to the outstanding properties of CNT. Their high aspect ratio, high strength and high stiffness lead to highly attractive zirconia/CNT composites. However, CNT are entangled into bundles rather than individual tubes which limit their benefit. Therefore a deep understanding of the effect of CNT dispersion on the mechanical properties of 3Y-TZP/CNT composites is needed.</p> <p>In this study, 3 mol. % Ytria Stabilized Zirconia (3Y-TZP) reinforced with different CNT content (0, 0.5, 1 and 2 wt. % CNT) were produced. The final nanocomposites were sintered using Spark Plasma Sintering (SPS) which results in near fully dense materials. Scanning Electron Microscopy (SEM) revealed the presence of CNT clusters at the grain boundaries of 3Y-TZP matrix. Nanoindentation test was carried out with a Berkovich tip indenter at 1000 nm of penetration depth (650 mN of maximum applied load). The results showed a decrease in the hardness and the elastic modulus with the addition of CNT. The reduction of hardness and elastic modulus is related to non-homogeneous distribution of CNT. Indentation fracture toughness and friction coefficient changed by the addition of CNT. Higher Electrical conductivity was measured using four-point probe setup technique. It was observed a substantial increase up to 500 S/m with the addition of 2 wt% CNT. To support these interesting electrical properties, Electrical Discharge Machining (EDM) has been performed and revealed that 1 and 2 wt% MWCNT/3Y-TZP composites are successfully machined.</p>
S5: 09 ⁴⁰ -10 ⁰⁰	<p style="text-align: center;"><i>Functionalization of Graphene Oxide for Engineering Applications</i></p> <p style="text-align: center;">A. Pruna, D Pullini, D. Busquets-Mataix (UPV, CRF)</p> <p>As directly correlated to graphene, graphene oxide (GO) has some advantages on its own. GO is produced from Graphite by chemical oxidation yielding different ratio of oxygen functionalities either on the basal plane and the edges. These functional groups are related to C-atoms where the sp² hybridization is lost to a sp³ configuration in the atoms concerned. The interesting point of this is that the functional groups present in either the plane or edges are different, being mainly epoxy and hydroxyl functionalities in the former and carboxyl ones in the latter. Therefore, by selecting the adequate reactive and/or process, the desired moieties for different applications can be added to GO. This fact is exploited in order to functionalize GO either in the basal plane, the edges or both. In our case, two different approaches have been followed to functionalise either the basal plane or the edges. On one hand, using silanes both hydroxyl and epoxy groups present in both faces of the basal plane react to attach the derived functional compounds from the silane molecule, that chosen adequately, can be added for instance as covalently bonded reinforcement to polymers. On the other hand, by the use of halogenation techniques, the carboxyl groups present in the GO edges can be further grafted to the desired functional groups, for instance to increase adhesion to a given substrate. The resulting functionalised GO can be reduced afterwards to restore the conjugated network in the basal plane, for instance, for electrical storage applications.</p>

S5: 10 ⁰⁰ -10 ²⁰	<p style="text-align: center;"><i>Amphiphilic grafted glycopolymers based on dextran to formulate biodegradable core/shell nanoparticles</i></p> <p style="text-align: center;">M. Léonard, A. Durand, J. Babin, C. Nouvel, <u>J.-L. Six</u> (UL)</p> <p>From some decades, our laboratory is studying amphiphilic polysaccharides with attractive surfactant and self-assembly properties. Such (co)polymers can be especially designed for applications in biomedical field or used as emulsion stabilizers for food or cosmetics. Until recently, these hydrophobic polysaccharide derivatives have been mainly obtained by covalently grafting hydrophobic moieties. Nevertheless, amphiphilic grafted derivatives of polysaccharide, which combine a hydrophilic polysaccharide backbone with hydrophobic synthetic grafts have been developed more recently at the LCPM. Firstly polylactide-grafted dextran (Dex-g-PLA) glycopolymers have been synthesized with various architectures (length and grafting density of PLA moieties/ length of the dextran backbone). Depending on the PLA weight fraction, they are either water- or oil- soluble, but they all display the capacity to self-organize in solution or at interfaces. Therefore they are able to formulate biodegradable nanoparticles. Using the same strategy, amphiphilic copolymers of dextrane-g-poly(methyl-methacrylate) (dex-g-PMMA), with controlled macromolecular architecture have been synthesized by ATRP.</p> <p>This talk will depict the synthesis of amphiphilic glycopolymers with an emphasis especially on the control of their macromolecular parameters. The emulsifying properties of previous copolymers will be then evidenced through the stabilization of submicronic emulsions to obtain core/shell nanoparticles.</p>
S5: 10 ²⁰ -10 ⁴⁰	<p style="text-align: center;"><i>Method for the evaluation of stretch blow moulding simulations with free blow trials</i></p> <p style="text-align: center;">J. Zimmer (Saarland University)</p> <p>In the Stretch blow moulding (SBM) process, Polyethylenterephtalat (PET)-preforms are biaxially deformed to produce thin walled bottles. Finite-Element (FE)-Simulations are an important tool to optimise this process in terms of material usage and product performance. Thereby, the implementation of the thermo-mechanical material behaviour of PET plays an important role to achieve realistic simulation results. A common approach for this purpose is to calibrate a material model with stress-strain curves from biaxial stretching experiments. Thin PET-sheets are stretched under defined temperatures and strain rates. However, these experiments include process simplifications concerning geometry, heating and deformation parameters. This paper presents a method for extracting temperature dependent stress-strain-curves from experiments close to the production process. PET-Preforms receive thermal treatment with Infrared (IR)-heaters from an SBM-machine and are subsequently inflated in free air (free blow trial). A high-speed-IR-camera is used to image the axial and radial temperature distribution on the preform immediately before blowing. The deformation process is recorded via 3d-high-speed-cameras with a frame rate of 2000/s. The cameras are synchronised with a pressure sensor to consequently calculate reliable stress-strain curves at any point on the preform. In addition FE-simulations of the free blow trials are conducted using a material model calibrated with the simplified stretching experiments of thin PET sheets. Resulting stress-strain-curves from simulations and free-blow-trials are finally compared to evaluate the quality of the material model as well as the underlying testing procedure.</p>
S6: 11 ²⁰ -11 ⁴⁰	<p style="text-align: center;"><i>Tie-chain molecules, morphology and confinement effects in poly(ethylene naphthalene-2,6-dicarboxylate) (PEN)</i></p> <p style="text-align: center;">I. Royaud, E. Nikaj, L. David (UL, LU)</p> <p>The glass transition dynamics and confinement effects in poly(ethylene naphthalene-2,6-dicarboxylate) (PEN) were studied by broadband dielectric relaxation spectroscopy (DRS) in relation with semi-crystalline morphology. PEN samples were obtained by cold crystallization at different crystallization temperatures (T_c ranging from 165 to 240°C) and crystallization times (t_c from 30 min to 24 h). Differential scanning calorimetry and X-ray diffraction shows that the crystallinity ratio (X_c) increases when T_c and t_c increase. The glass transition relaxation is shifted to higher temperatures as t_c increases but this confinement effect decreased with increasing T_c. The origin of this anomalous dynamics can be related to (i) the crystalline lamellar stack morphology revealed by small angle X-ray scattering (SAXS) and (ii) chain scission occurring during annealing at the</p>

	<p>crystallization temperature. As a result, the density of tie-chain molecules (chain portions bridging crystallites) can be considered as the key factor for the understanding of confinement effects in semicrystalline polymers. Accordingly the confinement effects on the glass transition dynamics can be optimally rationalized as a function of a characteristic length intermediate between the interlamellae thickness l_a and that of the theory of Brown and Huang $2l_c + l_a$ where l_c is the crystallite thickness.</p>
S6: 11 ⁴⁰ -12 ⁰⁰	<p style="text-align: center;"><i>Influence of the mechanical stress and the filler content on the hydrostatic compression behaviour of natural rubber</i></p> <p style="text-align: center;">J. Zimmermann, M. Stommel (Saarland University)</p> <p>The behaviour of natural rubber (NR) compounds under mechanical stress is often reported. An important and widely discussed effect that occurs is the Mullins effect. During the first loading cycles in a tensile test for example, a stress-softening effect is observed. This and other effects on the mechanical behaviour are reported for different rubber materials with and without different types of filler and filler contents. Besides, the hydrostatic compression behaviour is affected by the type and content of filler as well, which is shown for an NR with and without waxes and different contents of carbon black (CB) in this contribution. In contrast to the Mullins effect, there is no dependence of the number of loading cycles on the volumetric behaviour determined in hydrostatic compression tests. Furthermore, the influence of the previous stress-softening due to mechanical stress on the compression behaviour is elaborated. Cyclic uniaxial tensile tests were performed to realise the stress-softening in the rubber materials. The subsequent compression tests are compared to compression tests without any pre-stretching to determine the influence of previous mechanical loading on the compression behaviour of natural rubber with different filler contents.</p>
S6: 12 ⁰⁰ -12 ²⁰	<p style="text-align: center;"><i>Development of constitutive model for composites exhibiting time dependent properties</i></p> <p style="text-align: center;">L. Pupure, R. Joffe, J. Varna, B. Nyström (LTU, Swerea SICOMP)</p> <p>During the few past years the development of natural fiber composites for structural applications has gained the momentum. Mainly the efforts in development of these materials were focused on the composites with synthetic matrices. But most recently several bio-based resins (Tribest, EpoBioX etc.) have been introduced, allowing production of whole bio-based composites. The latest results demonstrated that these composites are comparable with glass fiber reinforced polymers in terms of stiffness. However due to variability of fiber properties and limited filament length it is complicated to arrange and control fiber alignment in composites as well as ensure stable, predictable composite properties. Therefore, another type of reinforcement with natural origin has caught attention of researchers – Regenerated Cellulose Fibers (RCF). These fibers are continuous with constant, reproducible cross-section and properties but with one significant disadvantage - they exhibit highly non-linear behavior. Thus, this reinforcement should be treated as material with time-dependent properties.</p> <p>Schepary developed model for time-dependent materials. This model has been successfully applied to short fiber (natural and synthetic) and long synthetic fiber composites. However, in order to apply this model, large number of time-consuming tests on studied composites must be performed. Therefore, our objective is to improve this model in such a way that only input of properties of constituents is required to predict behavior of material with any composition.</p> <p>Visco-elasticity and viscoplasticity has been analyzed by performing creep tests at different time steps and stress levels, and extent of damage is evaluated by performing stiffness degradation tests of fibers, matrix and composite.</p>

S6: 12 ²⁰ -12 ⁴⁰	<p style="text-align: center;"><i>Correlation between mechanical and dielectric properties of Alfa/Wool/ Polymeric hybrid fibres reinforced polyester composites</i></p> <p style="text-align: center;">A. Triki, Med. A. Omri, M. Guicha, Med Ben Hassen, M. Arous and A. Kallel (LaMaCoP, ISET Ksar Hellal)</p> <p>Dielectric measurements and tensile testing of polyester/natural fibre (Alfa/wool) and thermo-binder fibres (PE/PET) composites were investigated in order to study the adhesion of the fibres in the polyester matrix. Two composites #1 and #2 having a relative fraction of Alfa/wool and thermo-binder (PE/PET) as follows 17:1:2 and 17:2:1 were characterized in this study respectively. The obtained results revealed that the fibres adhesion in the matrix was better in the composite #1 than in the composite #2. Indeed, the analysis of the interfacial or Maxwell-Wagner-Sillars (MWS) polarization intensity, using the Havriliak–Negami model, showed a lower intensity and the tensile testing exhibited a higher Young modulus in the composite #1. So the thermo-binder fibres improve this adhesion.</p>
S6: 12 ⁴⁰ -13 ⁰⁰	<p style="text-align: center;"><i>Mean-Field Homogenization Model with a Quadric Matrix Yield Surface to Predict the Strength of Short-Fiber Polymer Composites</i></p> <p style="text-align: center;">J.-M. Kaiser, M. Schöneich, M. Stommel (Saarland University)</p> <p>In the last decade several authors have successfully predicted progressive damage and strength of composite materials with different mean-field homogenization models. These micromechanical models are based on the Eshelby solution for spherical inclusions embedded in a matrix and they allow the calculation of the mean stresses and strains in the constituents. In the authors' contribution an incremental mean-field approach is chosen to calculate the elasto-plastic behavior of polymer composites with arbitrarily dimensioned and oriented inclusions. Commonly, in such models a von-Mises criterion is used to calculate the elastic-plastic matrix behavior. However, since it is well known that polymer materials show a different yielding under tension and compression, an anisotropic hardening and since the plastic deformation does not happen at a constant volume the existing model is extended by incorporating a quadric yield surface for the elastic-plastic matrix behavior. For the calibration of the chosen quadric yield surface one requires tension, shear and compression tests. This requirement is seen as the starting point for the development of a new test specimen, which allows the conduction of all three required experimental tests. In this contribution the developed test specimen and experimental results are presented. Furthermore, this mean-field model is used to integrate failure criteria such as a Tsai-Hill and Tsai-Wu model to predict the strength of short fiber reinforced polymer composite parts. The results are evaluated against the results of a mean-field approach with a von-Mises yield criterion.</p>

	Posters
P1	<p style="text-align: center;"><i>in situ Study of sintering of alumina-zirconia nanocomposites obtained by the infiltration method</i> F. G. Marro, E. Camposilvan and M. Anglada (UPC)</p> <p>Alumina toughened zirconia (ATZ) nanocomposites were prepared by means of infiltration of an aluminium salt solution into porous pre-sintered tetragonal polycrystalline zirconia doped with 3 % molar of yttria (3Y-TZP). The porous 3Y-TZP, obtained by pre-sintering at 1100 °C, was dipped into the solution and then sintered at 1450 °C. The process yielded fully dense nanocomposites composed of zirconia and α-alumina grains with enhanced properties with respect to dense 3Y-TZP, such as indentation fracture toughness, hardness and resistance to low temperature degradation. The present work is focussed on the study of the microstructural changes that take place at different sintering temperatures ranging from 1100 °C to 1400 °C. Focussed Ion Beam (FIB) was used to produce polished cross-sections at the different sintering steps. It is observed that alumina is initially deposited around the 3Y-TZP granules in the pre-sintered material, whereas increasing the temperature over 1200 °C results in porosity reduction and alumina grains formation. The process of surface porosity evolution and in-situ sintering of alumina inside the pores is studied and discussed. The final microstructure shows a dispersion of alumina grains into the 3Y-TZP matrix, with isolated zirconia grains inside alumina crystals. One advantage of this processing method is its simplicity and effectiveness in obtaining interesting ATZ nanocomposites.</p>
P2	<p style="text-align: center;"><i>Surface treatments on zirconia ceramics: a comparative study</i> F.G. Marro, B. Londiche, Q. Flamant and M. Anglada (UPC)</p> <p>Due to its outstanding mechanical properties and to its bio-compatibility, zirconia is one of the most suitable materials for biomedical applications such as joint replacements and dental implants. The quality of the interface between the bone and the ceramic surface is a determinant factor for a good bone-to-implant anchorage. Whereas the conventional fabrication of zirconia usually results in relatively smooth surfaces, roughness is known to be a key parameter for a good osseointegration. There is therefore a strong interest in developing a process that produces the adequate surface morphology.</p> <p>In this study, the effect of acid etching on zirconia surface was investigated. 3Y-TZP samples were immersed for different times in different etching solutions, containing respectively highlyconcentrated hydrochloric, sulfuric and hydrofluoric acid. For comparison, other 3Y-TZP samples were sand-blasted, using a process optimized in a previous study. Whereas no significant effect was observed when using hydrochloric acid, changes in the surface morphology were evidenced for sulfuric and hydrofluoric acid. The hydrofluoric acid etching resulted in a considerable increase of the surface roughness. The surface microstructure of the most affected samples was fully characterized as well as the mechanical properties. The comparison of these results with those obtained with the sand-blasted samples is still under discussion.</p>
P3	<p style="text-align: center;"><i>Finite Element Analysis and Experimental comparison of the Crack Opening Displacement Profile in the Damaged Cross-ply Laminates</i> M. S. Loukil, J. Varna and Z. Ayadi (LTU, UL)</p> <p>During the service life composite laminates undergo complex combinations of thermal and mechanical loading leading to microdamage accumulation in the plies. The most common damage mode and the one examined in this work is intralaminar cracking in layers. The crack opening displacement (COD) and the crack sliding displacement (CSD) during loading reduce the average stress in the damaged layer, thus reducing the laminate stiffness.</p> <p>These parameters depend on material properties of the damaged layer and surrounding layers, on layer orientation and thickness. Previously these</p>

	<p>parameters have been calculated using finite element method (FEM) assuming linear elastic material with idealized geometry of cracks. To validate these assumptions experimentally the displacement field on the surface of a [90/0/90], [90/0]_s and [90₃/0]_s carbon fiber/epoxy laminates specimens with multiple intralaminar cracks in the surface layer is studied. The profile of the COD along the width is investigated for each single crack. The specimen full-field displacement measurement is carried out using ESPI (Electronic Speckle Pattern Interferometry). The effect of crack interaction as well as the effect of the thickness of 90° layers on the COD is given in this paper.</p>
P4	<p style="text-align: center;"><i>3-D Characterization by SEM/FIB tomography of multiligament zones at the crack tip of cemented carbides</i> J. M. Tarragó, E. Jiménez-Piqué and L. Llanes (UPC)</p> <p>Cemented carbides are ceramic-metal composite materials that combine the hardness and wear resistance of the ceramic particles with the toughness of the metallic phase. Their improved toughness resides in the plastic deformation of the ductile metallic binder ligaments behind the crack tip that act as the main crack shielding mechanism. Through the observation of crack-tip micrographs it can be stated that the bridging multiligament zone usually comprises between two and four ligaments and have a length of about five times the mean carbide intercept length. However, these observations are limited to the side view of the surface of arrested cracks and there is no evidence of the development of the bridging mechanisms inside the material. Thus, it is the aim of this investigation to asses a 3-D characterization of the crack-microstructure interaction at the tip of cracks induced at notches under compressive fatigue and further propagated under monotonic loading. With this purpose, a crack is generated and propagated on a coarse grained WC/Co 11%wt cemented carbide and then, the SEM/FIB tomography technique is implemented by means of cross-sectioning and imaging the crack tip, followed by reconstruction of the 3D volume.</p>
P5	<p style="text-align: center;"><i>Mechanical Behavior of Bio-based Composites and Their Constituents at Different Humidity Levels</i> N. Doroudgarian, L. Pupure and R. Joffe (LTU)</p> <p>During the few past years the development of natural fiber composites for structural applications has gained the momentum. Mainly the efforts in development of these materials were focused on the composites with synthetic matrices. But most recently several bio-based resins (Tribest, EpoBioX etc.) have been introduced, allowing production of whole bio-based composites. The latest results demonstrated that these composites are comparable with glass fiber reinforced polymers in terms of stiffness. However due to variability of fiber properties and limited filament length it is complicated to arrange and control fiber alignment in composites as well as ensure stable, predictable composite properties. Therefore, another type of reinforcement with natural origin has caught attention of researchers – Regenerated Cellulose Fibers (RCF). These fibers are continuous with constant, reproducible cross-section and properties but with one significant disadvantage - they exhibit highly non-linear behavior. Thus, this reinforcement should be treated as material with time-dependent properties.</p> <p>Schepary developed model for time-dependent materials. This model has been successfully applied to short fiber (natural and synthetic) and long synthetic fiber composites. However, in order to apply this model, large number of time-consuming tests on studied composites must be performed. Therefore, our objective is to improve this model in such a way that only input of properties of constituents is required to predict behavior of material with any composition.</p> <p>Visco-elasticity and viscoplasticity has been analyzed by performing creep tests at different time steps and stress levels, and extent of damage is evaluated by performing stiffness degradation tests of fibers, matrix and composite.</p>

<p>P6</p>	<p style="text-align: center;"><i>Influence of Hydrogen Environment on Fatigue Crack Growth in Forged Ti-6Al-4V: A Fractographic Analysis</i> R. Gaddam, R. Pederson, M. Hörnqvist, M.-L. Antti (LTU, GKN, Chalmers)</p> <p>In this study, the influence of hydrogen environment (15 MPa) on the fatigue crack growth in forged Ti-6Al-4V at room temperature is investigated. It is observed that at $21 < \Delta K > 25 \text{ MPa}\sqrt{\text{m}}$, there exists a change of fatigue crack growth rate (FCGR) in hydrogen environment, and it is accelerated at $\Delta K > 25 \text{ MPa}\sqrt{\text{m}}$. FCGR in hydrogen environment is dependent on the stress intensity levels (ΔK). Detailed fractographic analysis of the fracture surfaces were performed at different ΔK using high-resolution scanning electron microscope (HR-SEM). Fatigue striations were observed in air and hydrogen at $\Delta K < 21 \text{ MPa}\sqrt{\text{m}}$. At $\Delta K > 21 \text{ MPa}\sqrt{\text{m}}$, secondary cracks were observed in hydrogen environment. The differences in appearances of fracture surfaces in air and hydrogen are discussed.</p>
<p>P7</p>	<p style="text-align: center;"><i>The Effect of Crystallographic Orientation on Solid Metal Induced Embrittlement of Ti-8Al-1Mo-1V in Contact with Copper</i> P. Åkerfeldt, R. Pederson, M.-L. Antti, Y. Yao, U. Klement (LTU, GKN, Chalmers)</p> <p>Solid metal induced embrittlement (SMIE) occurs when a metal experiences tensile stress and is in contact with another solid metal with a lower melting temperature. SMIE is believed to be a combined action of surface self-diffusion of the embrittling species to the crack tip and adsorption of the embrittling species at the crack tip, which weakens the crack tip region. In the present study, both SMIE of the near alpha alloy Ti-8Al-1Mo-1V in contact with copper and its influence on crystallographic orientation have been studied. U-bend specimens coated with copper were heat treated at 480°C for 8 hours. One of the cracks was examined in detail using electron backscatter diffraction technique. A preferable crack path was found along high angle grain boundaries with grains oriented close to [0001] in the crack direction; this indicates that there is a connection between the SMIE crack characteristics and the crystallographic orientation.</p>
<p>P8</p>	<p style="text-align: center;"><i>Case study of grate-chain degradation in a Grate-Kiln process</i> E. Nilsson, L. Pettersson and M.-L. Antti (LTU, LKAB)</p> <p>Austenitic stainless steels are often used in high temperature applications due to their inherent resistance to corrosion. The grate-chain in some Grate-Kiln processes for sintering of iron pellets is made of these austenitic steels to withstand the severe environment. It has been shown however that the grate-chain is affected by several degrading mechanisms in the harsh environment of the sintering process. A grate-chain that had been used for 13 months in production was investigated in order to find the mechanisms of degradation. Results show that slag products are accumulated on the grate-chain during time and interact with the steel mainly due to the content of alkali metals. The resistance towards degradation seems to decrease with time which is suggested to be caused by the depletion of chromium.</p>
<p>P9</p>	<p style="text-align: center;"><i>Electrical transport in bundled single-wall carbon nanotubes under high pressure</i> M. Noël, Y. Volkova, P. Zelenovskiy, M. Mases, A. Babushkin, A. V. Soldatov (LTU, UFU)</p> <p>According to recent experimental data single wall carbon nanotubes (SWCNT) exhibit a sequence of phase transitions and demonstrate a high structural stability up to 35 GPa of non-hydrostatic pressure beyond which an irreversible transformation occurs. Here we report a study of electrical transport in SWCNTs at pressures up to 45 GPa in the temperature range of 300 - 400K. High pressure was generated in diamond anvil cell. The anvils are made of electrically conducting "carbonado"-type synthetic diamond. In the pressure range 10-25 GPa the CNT electrical resistance decreases considerably, whereas above 25 GPa it remains essentially unchanged. Such behaviour of the resistance can be connected to a structural modification of the SWCNTs accompanied by change of the conductivity character at high pressure. Raman spectra of the samples recovered after 30 GPa exhibit a large increase of D/G band intensity ratio. The Radial Breathing Mode part of the spectra remains essentially</p>

	unaltered which testifies for structural integrity of the nanotubes after exposure to high non-hydrostatic pressure and lack of covalent interlinking between the tubes. Pressure dependences of resistance, activation energy for conductivity and charge carriers mobility were determined and discussed.
P10	<p style="text-align: center;"><i>Chitosan based nanocomposite membranes with cellulose nanowhisker as nanoadditive</i> Z. Karim, M. Grahn, K. Oksman, A. P. Mathew (LTU)</p> <p>Biobased nanocomposite membranes were prepared using chitosan as the matrix and cellulose nano whisker as the reinforcing phase. Cellulose nanowhiskers were isolated from cellulose sludge from special cellulose production. Atomic force microscopy of the nanowhiskers showed diameters of 10 -20nm and lengths of 250 - 350nm. Nanocomposites were prepared in 1:1, 1:2 and 1:3 ratios to investigate the effect of nanoadditive concentration on the membrane properties. The nanocomposites were prepared by solution mixing followed by freeze-drying, to obtain porous structures with high degree of internal surface area. These nanocomposites were further treated with ammonia vapours to prepare the crosslinked nanocomposites and thereby stabilize it towards moisture and pH variations. The morphology, surface area, crystallinity, porosity, and mechanical properties of prepared membranes were studied. The effect of the nanocomposite composition, crosslinking and the pore size distribution on the water transport through the membranes was also evaluated.</p>
P11	<p style="text-align: center;"><i>Electrospun chitosan nanofiber random mats reinforced with cellulose nanowhiskers</i> N. Naseri, C. Algan, K. Oksman, A. P. Mathew (LTU)</p> <p>Chitosan is a non-toxic, antibacterial, biodegradable and biocompatible biopolymer used extensively for biomedical applications such as tissue engineering, drug and gene delivery, wound healing etc. Electrospinning of chitosan solution in acetic acid (50%) was carried out at 25 kV, gap distance of 155 mm, flow rate 13 mL/h. Cellulose nanowhiskers having diameters of 5-10 nm and aspect ratio of ≈ 150, were isolated from microcrystalline cellulose (MCC) and used as the reinforcement in the electrospun random mats. The mats were further crosslinked using genipin to improve mechanical properties. The electrospun fibers had diameters in the range of 130-300 nm. With inclusion of the whiskers decreased 50% of average fiber diameters. The mechanical properties of electrospun mats increased as a function of nanowhisker addition as well as crosslinking. These electrospun mats are expected to find application in wound dressing, burn healing etc.</p>
P12	<p style="text-align: center;"><i>Visible, Infrared and Incoherent Light Transport optical techniques for in-situ characterization of semi-crystalline polymer</i> S. Andre, Y. Meshaka, L. Farge (UL)</p>
P13	<p style="text-align: center;"><i>Tailored friction properties and enhanced run-in behaviour by geometrical interlocking of laser interference patterned surfaces</i> A. Rosenkranz, C. Gachot, M. H. Müser and F. Mücklich (Saarland University, JSC)</p> <p>Friction and related tribological phenomena play a decisive role in technological and biological systems. For many years, a lot of research groups have sought to understand the origin of friction and to enhance the tribological performance of rubbing surfaces. In this context, the ability to friction on different scales is of utmost importance. Laser surface texturing (LST) has shown to be a very promising technique to create surface modifications with feature sizes in the micrometer range. The laser interference metallurgy (LIMET), one possible approach of LST, is used to produce a well defined surface topography with line-like pattern. Commercial stainless steel samples (1.4301) were irradiated with a high power pulsed solid state laser (pulse duration of 10 ns, repetition rate of 10 Hz and wavelength of 355 nm) using a two beam interference configuration creating different structural wavelengths. The tribological testing was performed using a ball on disk configuration in linear</p>

	<p>oscillating test conditions. In order to control the involved contact geometries and the frictional response, both contacting bodies were structured with the same pattern and the energy density.</p> <p>The patterned contacting surfaces have been investigated with regard to the possibility to geometrically interlock depending on the structural periodicity and the relative alignment. Furthermore, it can be stated out that depending on the relative alignment and the structural periodicity, geometrical interlocking between the contacting bodies is possible thus leading to modified frictional properties and enhanced run-in behaviour.</p>
P14	<p><i>Biological Response to Wear Debris and Wear Properties of Prosthetic Joint Materials: A Review</i> S. Suner, J. Tipper and N. Emami (LTU)</p>
P15	<p><i>Tribocorrosion behaviour of Hf in Simulated Body Fluids</i> J. Rituerto, X. Hu, A. Neville, N. Emami (LTU)</p>
P16	<p><i>Tribology, Corrosion and Tribocorrosion of Metal on Metal Hip Implants: A review</i> J. Rituerto, X. Hu, A. Neville, N. Emami (LTU)</p>
P17	<p><i>Mechanical and thermal characterisation of novel UHMWPE-nano composite. A comparative study against virgin UHMWPE</i> D. Ramanenka, E. Enqvist, N. Emami (LTU)</p>
P18	<p><i>Design and characterization of cellulose fibers with hierarchical structure for polymer reinforcement</i> A. Hajlane, H. Kaddami, R. Joffe, L. Wallström (LTU, Cadi Ayyad University)</p> <p>This paper describes an approach to manufacture hierarchical composites from environmentally friendly materials by grafting cellulose whiskers onto regenerated cellulose fibers (Cordenka 700). Fourier Transform Infrared spectroscopy, Scanning Electron Microscopy and X-ray diffraction analysis were performed to verify the degree of modification. The mechanical properties of the unmodified and modified fibers were analyzed using fiber bundle tensile static and loading-unloading tests. To show the effect of cellulose whiskers grafting on the Cordenka fibers, epoxy based composites were manufactured and tensile tests done on transverse uni-directional specimens. The mechanical properties were significantly increased by fiber modification and addition of the nano-phase into composite reinforced with micro-sized fibers.</p>
P19	<p><i>Fibre Orientation Investigation in Short Natural Fibre Reinforced Composites Using Synchrotron Imaging</i> A. Arab, M. Stommel, L. Wallström (LTU, Saarland University)</p>

NOTES



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