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CYCLE DE CONFÉRENCES DE CHIMIE

Avec le concours de : ***Manufacture Française des Pneumatiques MICHELIN***
Centre de Développement Préclinique, Schering-Plough
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Section Auvergne de la Société Française de Chimie
U.F.R.S.T. / Master de Chimie / Département de Chimie

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Amphi de Chimie Paul REMI - (Site des Cézeaux)

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Functional nanopaper, aerogels and biocomposites from cellulose nanofibers

The interest in new types of functional and engineering polymer materials from renewable resources is increasing. In order to come up with radically new materials design, a bottom-up approach can be used, where novel material structures are created. For wood-based materials, this approach is stimulated by recently developed nanoparticles, including nanofibrillated cellulose (NFC) and cellulose nanocrystals (CNC).
NFC is obtained by disintegration of wood pulp into nanofibers with typical dimensions of 5-40 nm in diameter and a few µm in length. These are dimensions roughly three orders of magnitude smaller than regular wood fibers. An interesting observation is that nanopaper sheets manufactured from NFC show exceptional tensile strength[1](200-400 MPa) and a strain-to-failure as high as 10% (compared with 2-3% for conventional paper structures). Furthermore, other interesting functionalities have been reported for nanopaper such as low gas permeability, optical transparency and low thermal expansion[2]. This opens possibilities for new applications such as coatings, electronic devices, flexible displays, loudspeaker membranes etc. An interesting possibility is to use papermaking approaches to prepare organic-inorganic composites with nacre-like structure and interesting mechanical properties and fire-retardance characteristics[3,4.]
NFC can also be used to prepare polymer foams competing with expanded polystyrene (EPS) in terms of physical properties[5]. Ultra-high porosity materials with a solid content of only 0.5% by volume have also been prepared[6]. These materials still have substantial mechanical robustness, and are interesting for high-performance packaging applications (low peak stress packaging materials for protection of delicate goods) and thermal insulation. Furthermore, we

have demonstrated the feasibility of nanofiber aerogels as templates for novel functional materials[7] such as very lightweight magnets and magnetic nanopaper[8].
Although these new material concepts are interesting, many challenges remain, where the main ones include development of manufacturing schemes suitable for industrial scale. Still, the presented material concepts, and the improved properties they offer, may provide incentive for such a development.

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