

ARBORANANO, THE CANADIAN FOREST NANOPRODUCTS NETWORK: GIVING CANADIAN INDUSTRIES AN EDGE IN THE GLOBAL MARKETPLACE

Nanotechnology is poised to take the forest products industry in new directions. Nanoscale materials extracted from wood fibre, and the application of other nanomaterials to traditional forest products represent golden opportunities for Canada. Our manufacturing industries in various sectors are getting ready to take a natural, abundant and renewable resource — Canada's forests — and parlay it into all kinds of new high-tech, value-added green products.

ArboraNano, the Canadian Forest NanoProducts Network, builds cross-sector partnerships and supports R&D projects to create new products and processes from forest materials and nanotechnology, giving Canada an edge in this new global marketplace.

ArboraNano

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Why Canadians are getting excited about cellulose

Partnerships and projects that give Canada an edge in the global marketplace

Interviews

Pierre Lapointe - A green marriage of science and industry

Mark Andrews - Environmentally friendly inks and encryption technologies

Featured projects

Improving the performance of drilling muds

Increasing strength and gloss control of wood clear coatings

News Briefs

ARBORANANO NETWORK DIRECTOR APPEARS BEFORE THE STANDING SENATE COMMITTEE ON AGRICULTURE AND FORESTRY

ArboraNano Network Director Ron Crotogino testified before the Standing Senate Committee on Agriculture and Forestry on Oct. 21, 2010. Focusing on research, development and innovation, the Committee was interested in hearing Dr. Crotogino's views on composites and nano-reinforced materials.

Dr. Crotogino explained to the Committee that while the use of polymer composites is growing rapidly in many industries, the majority of these composites are made from petroleum-based materials. ArboraNano intends to promote an alternative to these materials by focusing on renewable and sustainable forest nano-materials such as nanocrystalline cellulose (NCC) and cellulose nano-filaments (CNF), which have unique properties such as strength and sustainability that are of high interest to manufacturers of many commercial products.

Dr. Crotogino emphasized to the Committee that the ArboraNano BL-NCE is integral to the mobilization and realization of the future of nano-materials and polymer composites. Through its R&D efforts and the eventual commercialization of these efforts, ArboraNano can help many Canadian industries enjoy new successes. ☺

NCC: DOMTAR AND FPINNOVATIONS JOIN FORCES TO DEVELOP INNOVATIVE CELLULOSE-BASED NANOMATERIAL AT NEW DEMONSTRATION PLANT

Domtar Corp. and FPInnovations recently announced that they have formed a new joint venture company to build the world's first one-metric-tonne-per-day commercial-scale nanocrystalline cellulose demonstration plant at Domtar's Windsor, Québec-based pulp and paper mill. Construction has begun and will take approximately 20 months to complete.

During the construction phase, the project will provide approximately 50 jobs and require services from engineering firms Teknika and Noram. Approximately 10 permanent positions will be needed to operate the demonstration plant. In addition, numerous researchers and scientific personnel have been and will continue to work toward delivering on the potential new nanocrystalline cellulose applications and products. ☺

THINK SMALL, GROW BIG

Four-hundred scientists, innovators and entrepreneurs met in Espoo, Finland from Sept. 27-29 at the 2010 International Conference on Nanotechnology for the Forest Products Industry to discuss "getting down to business with nanotech products." This conference, sponsored jointly by TAPPI (Technical Association of the Pulp and Paper Industry in Atlanta, Georgia) and VTT Technical Research Centre of Finland, brought together delegates from around the world to discover what's new in the exponentially growing field of forest nanotechnology.

Various chemical, mechanical and biological process technologies are used to unlock the potential of the nano-material that is an integral part of nature's most abundant polymer: cellulose. Each process yields distinct products with different morphologies ranging from nanocrystalline cellulose (NCC), where Canada has a decisive lead, to various forms of what might broadly be described as nanofibrillar cellulose (NFC) or microfibrillar cellulose (MFC). Each exhibits different properties and potential for application in a wide range of high-value products.

Research to understand the properties of these materials and innovation of new products using these materials are supported generously by government programs aimed at developing leadership positions in Finland, Sweden, Japan and the U.S., among others. Funding initiatives, such as the BL-NCE program that supports ArboraNano together with provincial government and industrial support, are essential to maintain Canadian leadership in the race toward a renewable, sustainable bio-economy based on our forest resources. ☺

WHAT IS ARBORANANO?

ArboraNano is the new Canadian Forest NanoProducts Network, founded by FPInnovations, NanoQuébec, and the Government of Canada's Business-Led Networks of Centres of Excellence program.

The Network was created to provide new business opportunities for the Canadian economy using Canada's renewable forest resources to manufacture new value-added products. Scientists and engineers in industry, academia and institutions are working together to research and develop products based on a plant-derived nanomaterial called nanocrystalline cellulose, or NCC. This can be used in many forms to create biocomposites, bioplastics, iridescent coatings, wear-resistant surface treatments and drug delivery systems — just to name a few applications.

Founding Members

FPInnovations

NanoQuébec

Industrial Partners

ArzoNobel

Alberta Innovates - BioSolutions

Alberta Innovates - Technology Futures

Alberta Pacific Forest Industries Inc.

Bell Helicopter Textron Canada Ltd.

FPInnovations

Handy Chemicals Ltd.

Kruger Inc.

Marquis Alliance

Nanoledge Inc.

NanoQuébec

Ontario BioAuto Council

The Woodbridge Group

Tissue Regeneration Therapeutics

Academic Partners

McGill University

Université de Sherbrooke

Université du Québec à Trois-Rivières

Université du Québec en Abitibi-Témiscamingue

Université Laval

University of Alberta

Government Partners

Canadian Institutes of Health Research

Fonds de recherche sur la nature et les technologies du Québec

National Research Council Canada

Natural Sciences and Engineering of Canada

Research Council of Canada

Social Sciences and Humanities Research

Council of Canada

ArboraNano

THE PROMISE AND POTENTIAL OF NCC

Canada's forests are used extensively for commodity products, such as pulp, paper and building products, but not for high-end applications in demanding environments. That's about to change, thanks to the several forms of nanocrystalline cellulose, including powder, gel, suspension, filament and film.

ArboraNano is encouraging scientists and engineers to use their creativity in researching and developing applications for NCC, while at the same time turning that creativity into potential commercial outcomes. NCC shows promise in many areas; ArboraNano is currently focusing on the forest products, automotive/aerospace and chemical/medical industries.

NCC is stronger and lighter than steel, it's recyclable and sustainable, and testing shows it's also non-toxic. As a result, NCC can be used in a number of applications, from reinforced polymers to high-strength textiles to advanced composite materials. ArboraNano is looking at how NCC can be used in coatings, adhesives, polymer systems and chemical additives for industrial applications, such as the manufacture of paints, pigments, inks and healthcare products.

COMMERCIAL APPLICATIONS FOR NCC

Pulp, paper and building products

Not only can it improve paper, packaging and building products, but it can also make those products more environmentally friendly. Traditional forest sector products will be enhanced with many types of new functionalities, allowing them to compete in markets traditionally occupied by petroleum-based products.

Coatings, paints and varnishes

NCC can be used in opaque coatings for wood to improve both weathering and mechanical properties. In aqueous paints, NCC can be used to make non-odorous environmentally friendly paints for cabinetry, furniture and building products, with improved durability and optical performance. NCC can also be used in wood varnish to greatly enhance a number of its properties and durability.

Specialty packaging and security

Films made of NCC appear iridescent, making them ideal for decorative paper and cosmetics. The colour palette can be controlled, and the resulting products are non-allergenic. Optical films enhanced with NCC can be used in specialty packaging, biosensors and security devices. Counterfeit products are a serious issue for Canadian pharmaceutical, electronic and packaging industries, and scientists are working on devising enhanced security inks with NCC to prevent counterfeiting and authenticate products.

Automotive and aerospace

In the automotive and aerospace industries, NCC can be used in coatings and composite materials for automobile and aircraft parts, as well as foams for automobile interiors.

Petroleum

In the petroleum industry, NCC can be used in oil recovery fluids, making it easier and more economical to get oil out of the ground. Laboratory investigations are looking into optimizing improved mud formulas for oil drilling and will eventually involve large-scale field trials.

Medical, pharmaceutical and cosmetic

In the medical industry, NCC can be used in biocomposites for bone, teeth and soft tissue repair, as well as drug delivery and nano-sensing, thanks to its benign characteristics. It can also be used in gels, creams and other products for medical and cosmetic applications.

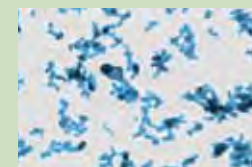
There's no shortage of uses for NCC. It not only has the potential to transform the forest products industry, but it will create new opportunities across industries — giving Canadian manufacturers an edge in the global marketplace.

In the pipeline



MULTI-LAYER WOOD COATINGS

As wood is a porous material, it is susceptible to cracks, deformation, rot and insects if not properly protected. In a project partly funded by FQRNT and NanoQuébec, Dr. Bernard Riedl and his associates at Université Laval, in collaboration with FPInnovations, are developing multi-layer wood coatings using NCC and other nanoparticles to protect and reinforce wood for a broad range of demanding applications.



MONITORING AND CONTROLLING NANOPARTICLE DISPERSION

Dispersion is key to unlocking the full potential of nanoparticles in new products. Dr. Carmel Jolicoeur from Université de Sherbrooke is working in partnership with FPInnovations and Handy Chemicals to better understand the surface reactivity of various nanoparticles and facilitate their dispersion into matrices for broader application in the consumer products industry. Support is also provided by FQRNT and NanoQuébec.



MOLECULAR MODELING OF NANOCRYSTALLINE CELLULOSE

Molecular modeling can be used to predict the three-dimensional nature of NCC, which has a number of unusual optical properties related to colour and iridescence. At Université du Québec à Trois-Rivières, Dr. Sylvain Robert and his team, in collaboration with FPInnovations and with support from FQRNT and NanoQuébec, are building molecular models to better understand these unique attributes and determine the best ways to take advantage of them so NCC can be integrated into a variety of consumer products.

Interview



Pierre Lapointe,
Chairman of the Board
of ArboraNano

A GREEN MARRIAGE OF SCIENCE AND INDUSTRY AIMED AT FOSTERING INNOVATION AND GROWTH

In 2009, Pierre Lapointe was appointed Chairman of ArboraNano, the Canadian Forest NanoProducts Network, a Business-Led Network of Centers of Excellence. He is also President and CEO of not-for-profit R&D consortium FPInnovations, a founding member of ArboraNano.

Q - WHAT IS ARBORANANO?

A - ArboraNano is one of four new Business-Led Networks of Centres of Excellence, or BL-NCEs, funded by the federal government, with NanoQuébec and FPInnovations as founding members.

Q - HOW DO BL-NCEs WORK?

A - BL-NCEs are a new type of network, driven by industry. The federal government, along with industry, has been looking at areas for future development of new products, and the nanotechnology sector was targeted as one potential area. ArboraNano brings together the forest industry, nanotechnology experts and Canadian manufacturers to jointly develop applications for forest nanoproducts that give them a competitive edge on the global market.

Our BL-NCE is led by industry, and that's what sets it apart from traditional NCEs. You need market intelligence, you have to understand there's a need somewhere, you have to explain that need, so it's reverse logic from what universities are used to — it's really a marriage of science and industry. It's our second year of operation and industry is looking at the development of new products for the Canadian forest sector outside of the paper industry, including the aerospace, automotive, and petroleum business sectors.

Q - HOW WILL THIS HELP THE FOREST SECTOR?

A - The forest sector has been challenged over the past few years. We're now seeing a wind of change. People from various industries are starting to understand that they need to innovate and market new products. Green products happen to be the way of the future, including nanoproducts from the forest industry. Since its inception, ArboraNano and its partners have been working more specifically on applications of nanocrystalline cellulose, or NCC which actually needs to be massively extracted from our forests as raw material. This opens the door of a promising market for the Canadian forest industry.

Q - WHAT IS NCC, AND WHAT SETS IT APART FROM DIFFERENT VERSIONS OF NANOCELLULOSE?

A - NCC is a structural element of naturally occurring cellulose found in plants and trees. It's crystalline, which is insoluble, so

when cellulose is separated from a fiber source and subjected to treatment by acid, the soft cellulose parts are dissolved, liberating a crystal, which we know as a nanocrystal. It can then be processed into solid flake, liquid and gel forms and converted into nanomaterials for use in new and existing products. A lot of other processes destroy the fiber, so the length and width ratio of the nanomaterial produced is very small compared to NCC. In Canada, we have slow-growth forests, which means we have an excellent fiber.

Q - WHAT'S THE PROMISE OF NCC?

A - The potential it has, especially for the forest, is to give a second life to the tree. It will mean much greener products. For example, in the transportation industry, NCC will be able to replace the hydrocarbon components used in automobiles and airplanes, so you'll have much greener products than you have today, and that's because NCC is totally recyclable.

Q - WE HEAR FPINNOVATIONS TOGETHER WITH DOMTAR IS OPENING A PRODUCTION FACILITY. WHAT IS ITS PURPOSE?

A - To go to commercial development of new products, we need to have much larger quantities of NCC being produced. We've convinced the Federal government, the Québec government and Domtar to create a new company as a joint venture, which will produce one tonne of NCC a day by the end of 2011. The plant is located in Windsor, Québec, and will be on-site with Domtar's pulp and paper mill. We will take the pulp as it is produced from Domtar and process it down to the nanoscale to produce NCC. If we are successful, in a few years we should be able to construct a 100-tonne-a-day plant. This shows that the forest sector is not as conservative as we thought. There are some innovators out there and Domtar is one of them.

Q - WHAT ARE THE BENEFITS OF PARTNERING WITH ARBORANANO?

A - You're able to double or triple the dollar value of your research and development budget because it's a joint project — in addition to having access to specific knowledge from top researchers and scientists from various industries and universities across Canada. NCC increases the strength and stiffness of materials, making it attractive for a number of new applications. It can also alter the surface of material like paper. However, the key advantage is the fact that you're introducing an environmentally friendly material. If you put a greener product on the market, you'll have a commercial advantage.

Q - HOW IS CANADA TAKING A LEADING ROLE?

A - Right now we're the only country that can produce a large quantity of nanocrystalline cellulose. We have an 18- to 24-month edge over any other country in the world. 🌱

Featured project

RESEARCH ON NANOCRYSTALLINE CELLULOSE (NCC) IS SEEKING TO IMPROVE THE PERFORMANCES OF DRILLING MUDS

**"Mud, mud, glorious mud,
nothing quite like it for cooling
the blood, so follow me follow,
down to the hollow, and there
let me wallow in glorious mud"**

— Flanders & Swann, 'At the drop of a hat', 1958



Like the melody that has lured a throng of hippos to the river, unique properties of NCC have attracted us to new application opportunities in drilling muds used in depleted oil reservoirs or fractured formations common to mature oilfields. While drilling muds account for only 10-15% of total drilling costs, they are often the cause of all operational problems in a drilling process.

Drilling fluids have to meet multiple and often conflicting performance requirements in drilling operations, such as: removing cuttings from the borehole, suspending cuttings, keeping the drill bit cool and clean during drilling, lubricating the drill pipe, stabilizing the borehole, all the while controlling drilling fluid losses to the formation.

A research project funded by ArboraNano, Alberta Innovates-BioSolutions and Marquis Alliance aims to develop an NCC additive for drilling muds that will give better fluid loss control in drilling operations. The research project, which will begin at the laboratory scale and culminate in full-scale oilfield drilling trials, will be led by Yaman Boluk, Nanofibre Chair in Forest Products, University of Alberta and Principal Scientist at NRC National Institute for Nanotechnology (NINT).

The mud formulations with NCC additives will be prepared by Alberta Innovates — Technology Futures and certain benchmark performance tests will be done by C-Fer Technologies. The drilling field tests of NCC formulated drilling fluids will be carried out by Marquis Alliance.


**"The objective is to develop
NCC-based drilling fluids
that will provide superior
invasion control and facilitate
the removal of protective drilling
mud from producing intervals."**

If successful, the project will solve one of the drilling industry's major problems and assist with the sustainability of the conventional oil and gas energy sector.

Although a wide variety of other additives are used and have been tried for the purpose of formulating drilling mud so that it has the desirable rheological properties, this is the first time that NCC will be used. Large-scale production of NCC has recently been announced by a joint venture created by Domtar and FPInnovations; a production facility capable of providing 1 ton of NCC per day is currently under construction in Windsor, Québec

The drilling fluid market in Canada is estimated to be worth \$300,000,000 per year, which corresponds to approximately 300,000 million tonnes of drilling fluid per year. As well, the Canadian drilling fluid market is only 10% of the North American market.

The Nanofibre Chair in Forest Products has been set up by the University of Alberta to conduct research on process technologies of nanofibrillated and nanocrystalline cellulose and their industrial applications. The Chair's research activities are also integrated into the National Research Council (NRC) of Canada's National Institute for Nanotechnology (NINT).

Alberta Innovates — Technology Futures is part of Alberta's research and innovation system and is helping to build sustainable businesses in Alberta. C-Fer is a full scale testing facility with expertise on drilling & completions. Marquis Alliance is a Canadian, integrated, full-service company that supplies drilling and completion fluids for the oil and gas industry. 

Interview



Mark Andrews,
Associate Professor at
McGill University

CANADA'S FORESTS HELP MCGILL DEVELOP GREEN INKS, ENCRYPTION TECHNOLOGIES

Mark Andrews is an associate professor at McGill University, who drafted a winning research proposal to work with ArboraNano. His team at McGill is using nanocrystalline cellulose, or NCC, to develop environmentally friendly inks and encryption inks for the security industry.

Q - HOW DID YOU BECOME INVOLVED WITH NANOTECHNOLOGY?

A - Originally I was doing research into advanced optical and electronic materials. There was an interest from industry in miniaturizing electronic circuitry and making more compact optical devices for optical communications, and there was a move toward looking at nanostructures.

Q - HOW ARE YOU PLANNING TO USE NCC IN A PROJECT SUPPORTED BY ARBORANANO?

A - NCC is amazing stuff. It can be suspended in water, but it's very insoluble, so it tends to self-associate. So you get what's called a liquid crystal phase, like the liquid crystal used in your laptop. This phase has gorgeous optical properties; it's iridescent, but you can control the iridescence by controlling how the nanocrystals associate. We got the idea that we could develop colour-enhancing ink that would act with polarized light in a unique way and that's the basis for encryption. We did some preliminary tests using inkjet printers and got some encouraging results, which were the foundation of our grant proposal.

Q - WHAT MARKET OPPORTUNITIES EXIST FOR THESE PRODUCTS?

A - According to PIRA, the Printing Industry Research Association, the global market for environmentally friendly inks is going to reach 7.2 billion euros in 2014, so it's huge. The inkjet component of that will grow at a compound annual growth rate of about 10 per cent, but there are other printing components that will account for about 70 per cent of the market. In addition, the global brand protection market is about US\$6 billion, but counterfeit drug sales this year will reach US\$75 billion. It's enormous. If you look at lost revenue for a pharmaceutical company, counterfeiting is about US\$90 million and illegal diversion is another US\$90 million. Just in terms of pharmaceuticals alone, encryption technologies are extremely important and that's why we targeted them.

Q - WHEN WILL WE START TO SEE COMMERCIALY AVAILABLE PRODUCTS?

A - That's highly dependent on what the NCC is being used for, but my group has already generated patented outcomes. In the area of inks, we've got research to do, and products require an

extra level of funding, which we're looking at now, so I would say prototype encryption inks are about a year and a half away.

Q - ARE THERE CHALLENGES TO WORKING WITH NCCS?

A - There are several challenges. One is finding a suitable source of the NCC itself. This is where the recent joint venture between FPIInnovations and Domtar is important. FPIInnovations developed a pilot plant facility to produce larger quantities of NCCs. There's a need for high-quality NCCs and right now that material is not commercially available, so that's an impediment to product development. But the joint venture will go a long way to improving that situation and will help keep Canada in a leadership position in terms of supplying the material to those who want to explore its properties. There's been excellent work on the safety of NCCs to humans and animals, and so far research conducted by FPIInnovations indicates the material is benign, so that's a big bonus. That does not mean, however, that if one changes the NCC that it will remain benign and one of the things we do as scientists is change the crystal to get new properties, so we need to check their behaviour. Another challenge is investment capital. Entrepreneurial investment in this country is at an all-time low, so one needs to hunker down and use one's best entrepreneurial style to get something going.

Q - IS THE FEDERAL GOVERNMENT INITIATIVE TO LAUNCH BUSINESS-LED NETWORKS OF CENTRES OF EXCELLENCE HELPING YOU?

A - These types of initiatives can help, and the role ArboraNano is playing is crucial. They're providing financial support, but they're also hedging their bets that something practical will come out of this. There are a lot of forest sector initiatives going on right now to help the industry ease its way into high-tech opportunities and NCC is definitely one of those. However, federal incentives still have to go through the bottleneck of venture capital houses, which makes disbursement of funds slower than some people would like and therefore removes the nimbleness from getting into opportunities around NCC right away.

Q - WHAT IS THE STATE OF ENTREPRENEURSHIP IN CANADA?

A - It's tough, but it's healthy in the sense that entrepreneurs never say no, only investors say no.

Q - WHY IS THIS IMPORTANT FOR THE FOREST PRODUCTS INDUSTRY?

A - If the forest industry gets into partnerships with companies that use its pulp for high-tech purposes, then they're doing something other than papermaking. It helps them diversify their business and show they're into good forest product management. And that's where the market opportunities lie. ☺

Featured project

USE OF NCC AS AN ADDITIVE FOR CLEAR COATINGS

Pierre Blanchet, Ph.D.
Group Leader, FPIInnovations

In collaboration with AkzoNobel, the largest global manufacturer of paints, varnishes, and coatings, Pierre Blanchet, Group Leader at FPIInnovations, is working on an additive that will enhance the rigidity of coatings for wood and control lustre. The project's promising applications will draw customers in the coatings industry, a \$20 billion market in the United States alone.



Clear coatings are all around us. Cars, many plastic products, printed microelectronic circuits and, obviously, wood products all require protection. Over the past five years, the use of nanoparticles by the coatings industry has enabled the creation of higher-performance products featuring new properties. A good number of these nanoparticles are inorganic, which means that it is hard to modify them. In many cases, this leads to the use of a variety of additives with a negative impact on certain aspects of product performance.

A new nanomaterial, nanocrystalline cellulose (NCC), opens up an array of possibilities thanks to its organic nature. NCC can be modified to improve its compatibility with various resins used in clear coatings, both water-phase acrylate and acrylate with a high solid content. FPIInnovations team will play a decisive role in identifying the best NCC candidates for the purposes of the current study.

The purpose of R & D is to take advantage of the organic nature of NCC in order to use it in a multifunctional context as an attractive additive, while controlling its impact on the optical properties of coatings. The R & D will also target the following specific objectives: carry out a study of the impact of NCC particle size on formulations with a high solid content, ensure dispersion quality and understand the necessary mechanisms for maintaining these dispersions over time, evaluate NCC's matting capacity and compare it with that of the main matting agents, evaluate NCC's potential as an effect pigment, and identify the mechanisms for controlling these effects in polymer films.

These research objectives will be reached through a master's project, a doctoral project and a post-doctoral project.

The master's project will evaluate and characterize NCC's matting capacity. Controlling lustre is an important part of producing clear coatings. Generally speaking, wax or silica is added to control shine. This is a typical example of the use of an inorganic filler leading to a reduction in the mechanical performance of coatings. As it has been determined that NCC has an impact on lustre and improves mechanical properties, it is imperative to characterize its matting capacity.

Micro and nanometric aluminum oxides are frequently used as additives to improve the mechanical performance of high solid content coatings. They have been widely studied by coatings research groups. A similar characterization for NCC will be carried out as part of a Ph.D. project, among other things, will study particle size, which has a major impact on the final observed properties. This study will define NCC grades for coatings. A study of the impact on the observed properties of grafting organosilane to NCC and using different mixing techniques will also help define NCC grades.

Finally, a post-doctoral student will try to reproduce some of the iridescent properties typical of films that are 100% NCC using only a low NCC filler rate. This project will position NCC as an effect pigment, unique among pigments in that it could enhance instead of reducing mechanical performance. The project will define strategies for obtaining iridescence in clear coatings, at the lowest possible cost.

In the pipeline



INKS BASED ON NCC FOR ENHANCED COLOUR AND ENCRYPTION

Anti-counterfeiting and other brand protection applications are being addressed by Dr. Mark Andrews from McGill University and his team, made up of associates from several organizations. They're developing new inks based on NCC that are more dynamic, complex and environmentally friendly with respect to both encryption and colour. This project is partially funded by ArboraNano's joint collaboration with Le Fonds québécois de la recherche sur la nature et les technologies (FQRNT) and NanoQuébec.



OPAQUE AND AQUEOUS NANOCOMPOSITE WOOD COATINGS

Dr. Bernard Riedl and his associates at Université Laval, in collaboration with FPIInnovations and with support from FQRNT and NanoQuébec, are creating "green" water-based wood coatings for indoor and outdoor use, which are more resilient than coating products available on the market today.