

Auto INNOVATIONS

FALL 2006

VOLUME 4 • NUMBER

2

Pondering the Possibilities of Powder

The alloying of metals has ushered in technological advances throughout human history, which is why the automotive industry welcomes their potential to provide significant gains in fuel economy. If new materials can yield lighter parts capable of the same performance, the overall efficiency of vehicles can be steadily improved.

The challenge, as always, is the sometimes tricky process of alloying. Among the most promising techniques to emerge in the past few decades has been powder metallurgy (PM), which enables shaped components to be made from combinations of metal powders. Although this approach may require more sophisticated and expensive equipment than traditional metallurgical processes, these costs are offset by the fact that it yields components requiring little or no finishing work.

Nevertheless, reducing the weight of various parts of a vehicle is more than just a matter of substituting lighter ones. Properties such as strength and fatigue must also be taken into account before these new parts can be installed. And as Dr. Carl Blais puts it, “the easy parts have already been replaced”.

Dr. Blais, a professor in Laval University’s Department of Mining, Metallurgy, and Materials, heads up the AUTO21 project on *Powder Metallurgy for High-Performance Components*.

“For PM to continue to grow, we have to target these components, such as those we find in transmissions and critical parts of the engine,” he says. “We play



Dr. Carl Blais of Laval University leads the project *Powder Metallurgy for High-Performance Automobile Components*.

with different alloying elements, ways of adding them to the base materials, then we characterize the mechanical properties trying to focus on fatigue.”

An overriding goal is to produce a highly compressible powder, which will increase the density and durability of the resulting metal. Alloys can therefore be produced through methods such as sintering, heating these powders to temperatures of about 1250 degrees C in a furnace atmosphere deprived of oxygen, so that atoms of iron will readily mix with those of other elements such as nickel, molybdenum, chromium, or manganese.

Dr. Blais notes that the collaboration between various research groups within AUTO21 has been extremely effective in sorting out some of the complexities of PM. His team at Laval, which specializes in steel, actively collaborates with facilities run by Dr. Paul Bishop

at Dalhousie University in Halifax and Dr. Gilles L’Espérance at Ecole Polytechnique de Montréal.

Each group has developed its own expertise with different metals – such as steel or aluminum – along with some specialized technology that can be shared through the network.

“We almost triple the equipment available to carry out our work,” says Dr. Blais, noting that substantial amounts of technical information flows from one laboratory to another. He adds that this dynamic research environment has also proven to be useful for luring good graduate students away from the outstanding job prospects in this field.

“It’s a way of creating added value for them,” explains Dr. Blais, who suggests that this interaction among labs in different parts of the country will enhance the career prospects of these students. ■

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.....Canada-Wide Science Fair Sponsorship.....

In addition to promoting automotive sector careers to university level students, AUTO21 is also promoting this sector to younger Canadians. In partnership with the Canadian Institute for the Relief of Pain and Disability, the Woodbridge Group and the Yves Landry Foundation, AUTO21 once again sponsored the automotive division at the Canada-Wide Science Fair in May.

Over 450 young people from across Canada participated in the national science fair in Saguenay, Quebec after advancing from local, regional and provincial competitions. Representing about 10 per cent of the 369 entries, 36 projects competed within the automotive division in three age groups. Participants are able to submit their single project into various award categories for opportunities to win multiple prizes.

“The projects were impressive, exhibiting a high level of scientific excellence,” said Anne Cascadden, AUTO21 network manager. Anne represented the partnership at the awards banquet. Many of the project themes paralleled the AUTO21 research themes, with topics including driver distraction, accident avoidance, fuel cell technologies, regenerative braking technologies and bioplasticizers. ■



Anne Cascadden, AUTO21 network manager, (centre) helped present awards to the junior, intermediate and senior categories of the automotive division. Here, she is pictured with some of the winners.

Yves Landry Award

The Yves Landry Foundation has selected AUTO21 to receive its annual “Program of the Year” award of excellence for 2006. The award recognizes the exceptional leadership and contributions AUTO21 has made promoting automotive sector careers to young Canadians. The Foundation promotes technological education and skills training for young people, and was established in 1998 to honour the late Yves Landry, chairman, president and CEO of Chrysler Canada Ltd. from 1990 to 1998.

“AUTO21’s HQP development activities are rather unique in the NCE program in that it was one of the first, and is still one of only a handful of networks to have a dedicated annual event for its student researchers,” said Dr. Peter Frise, AUTO21 Scientific Director and CEO.

The HQP Conference is held each year and is hosted by an automaker that provides a plant tour as well as judges for the annual poster competition. In addition, students hear from knowledgeable industry and research speakers and participate in a great social program to help build a community amongst themselves.

The award will be presented at the 7th annual Yves Landry Foundation STARS Gala on October 26th, 2006 at the Westin Harbour Castle in Toronto, Ontario. For ticket information, please visit www.yveslandryfoundation.com.

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Member of the Networks of Centres of Excellence of Canada
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**From the
*Scientific Director***

Dr. Peter Frise

One of the key measures of any NCE is its research excellence, and AUTO21 has had several recent reasons to celebrate its research successes.

AUTO21's 2006 Scientific Conference provided the venue for two award presentations to Network researchers. The final awards ceremony for the Honda Canada HQP Poster Competition took place on June 14th. Four student researcher teams had advanced from the earlier evaluation rounds at the HQP Conference held in May. It was a tough challenge to select just one first-place winner, but members of AUTO21's Scientific Advisory Committee persevered and awarded Steve Samborsky of the University of Waterloo for his hard work on the *Regenerative Braking Systems* project. Steve's professionalism and collegiality towards his colleagues from other schools on this project also deserves special mention.

Project researchers also had a chance to display their research excellence at the conference's Showcase of Innovation, a poster exhibit of AUTO21 projects. Again, the Scientific Advisory Committee had a difficult time selecting a winner, but they presented the Magna International Best Poster award to the *New Generation Steels II* project, led by Dr. Steve Yue of McGill University. More information on these two awards and the Conference can be found on page 5. AUTO21 appreciates the continued support of Honda Canada and Magna International for the sponsorship of these prizes, as well as the support of the other conference sponsors.

As part of the upcoming Networks of Centres of Excellence of Canada Annual General Meeting in December, a cross-network competition will take place in honour of Dr. Thomas Brzustowski, former chair of the NCE steering committee and former president of the Natural Sciences and Engineering Research Council. The new Chair's Award will be presented to one researcher from the 24 networks who exemplifies research excellence. During the spring and summer, all NCEs selected an internal winner to represent that network in the final round of evaluation. AUTO21 selected Dr. Anne Snowdon, of the project *Enhanced Child Safety in Automobiles*. Dr. Snowdon received a medal of honour for winning AUTO21's internal competition, and has a chance to win \$15,000 as the final winner of the inter-network portion of the competition. We look forward to the final award presentation at the NCE AGM in December, and wish Dr. Snowdon the best of luck.

AUTO21 is also excited to launch a new program to help completed projects transfer the developed knowledge and technologies to end users. A new Knowledge and Technology Transfer Fund (KTTF) has been launched for projects that began in fall 2003 and will end in spring 2007. This funding will help disseminate the information in a variety of ways to project partners and other sector users and thus help to complete the task of bringing new innovations to Canada's auto sector.

The AUTO21 Annual General Meeting will take place October 25th in Toronto. At that time, we will welcome a new chair of the board of directors and acknowledge the energetic leadership provided by Mr. Norman Lockington, the current chair. Mr. Lockington has been chairman since 2004, and we cannot thank him enough for his wisdom, guidance and unflagging enthusiasm and support of AUTO21. We wish Norm the best as he retires from his current role as vice-president of technology at Dofasco Inc. and moves on to the next phase of his busy and productive life. ■

Dr. Peter R. Frise
Scientific Director and CEO

Save the Date!

**AUTO21 Annual
General Meeting**

October 25, 2006
4:00-5:00 p.m.
Westin Harbourcastle Hotel,
Toronto, Ontario

For more details, please
contact: info@auto21.ca

The AUTO21 2005-2006 annual report
is available at www.auto21.ca.



HQP Conference Review

The 2006 HQP Conference set attendance records, with nearly 280 student researchers and project leaders participating in the two day conference. In addition to research presentations by the theme coordinators, six student researchers also had a chance to present their work to their colleagues. A professional development series provided students with opportunities to meet working professionals and gain advice on resumes, networking and other important skills.

AUTO21 appreciates the support of its conference and poster competition sponsor, Honda Canada Inc.



James Miller, senior vice-president of Honda Canada provided an insightful presentation at the conference's opening banquet.



Audrey Zavodsky, a GT-Series race car driver and corporate occupational health nurse at Ford Motor Company inspired students with her luncheon presentation.

Honda Canada HQP Poster Award

More than 70 student teams from across Canada vied for cash prizes and scientific honours at the Honda Canada HQP Poster Competition, a key part of the conference. Following an extensive poster review, the judges selected 16 semi-finalist teams to advance to the second round of judging, which included oral defences of the posters. From the 16, four advanced to the final round of competition at the AUTO21 Scientific Conference in June.

Semi-finalists in no particular order:

Advanced Automotive Seat Design,
University of Waterloo

Composite Acoustic Materials for Noise/Vibration Control, Queen's University

Powder Metallurgy for High-Performance Automotive Components, Ecole Polytechnique

Wrought Magnesium for Automobiles,
University of Alberta

Renewable Biofibres and Biomaterials for Interior Parts,
University of Toronto

New Generation Steels II, McGill University

New Generation Steels II, McMaster University

Chemical Hydrogen Storage Process Development,
Queen's University

On-Board Fuel Cell Powered Auxiliary Power Units,
Queen's University

Combustion of Low-Emission Automotive Tailored Natural Gas, University of British Columbia

Regenerative Braking Systems, University of Waterloo

Regenerative Braking Systems, University of Windsor

Neuro-Fuzzy Systems for Inspection in Manufacturing Processes, Queen's University

Canadian Automobile Research Simulation,
University of Guelph

Smart Technologies for Improved Acoustic Environment of Automobiles, Université de Sherbrooke

Electrical Power Management & Safety Systems,
University of Toronto

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A special thank you to the judges who met the challenge of reviewing the posters!

..... Scientific Conference Review

AUTO21 hosted its fifth annual Scientific Conference in Vancouver, British Columbia on June 13-14, 2006. More than 200 researchers, industry and government representatives gathered for a stimulating panel program that focused on hot topics within the automotive sector. Speakers came from all AUTO21 research themes, as well as automotive-related companies and organizations around the world.



Each AUTO21 project was featured at the Showcase of Innovation, a venue to promote the Network's innovative research results. Following an extensive poster evaluation, the Magna Best Project Poster was awarded to Dr. Steve Yue of McGill University, leader of the project *New Generation Steels II*. Special thanks to members of the Scientific Advisory Committee for meeting the challenge of selecting the winner of this poster competition and the Honda Canada HQP Poster Competition.



The final round of evaluation for the Honda Canada HQP Poster Competition semi-finalists occurred on June 13, with the awards presented on June 14. Sean Thompson of Honda Canada (right) awarded first place honours to Steve Samborsky, a student researcher contributing to the *Regenerative Braking Systems* project at the University of Waterloo. Steve is supervised by the project's leader, Dr. Steve Lambert.



Dr. J. Gary Smyth, director of the power-train systems research laboratory at General Motors Research and Development provided the conference's keynote address at the opening banquet.

AUTO21 appreciates the support of its 2006 conference sponsors

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 Toyota Canada
 Transport Canada
 University of Windsor
 Vancouver Fuel Cell Vehicle Program

Safety Comes First in the Hydrogen Economy

Before we can usher in a new generation of automobiles powered by hydrogen, we will have to set standards for how this volatile energy source is to be stored and transported. This subject is drawing international attention, and among the researchers at the forefront of these efforts are participants in the AUTO21 project, *Hydrogen Safety and Infrastructure for Hydrogen Vehicles*.

“It’s a very hot topic at the moment,” says Dr. Pierre B nard, the physicist at Universit  de Qu bec   Trois Rivi res who directs the project. He explains that even the most fundamental aspects of storage must be considered, such as whether hydrogen is compressed as a gas, liquefied, stored on the surface of carbon compounds or in metal hydrides.

“Each of these methods has particular safety implications,” he says.

By way of exploring those implications, Dr. B nard and his colleagues are using computational fluid dynamics to develop sophisticated models that describe the behaviour of hydrogen under different sets of conditions. The results simulate the way the gas would disperse during leakage in a service station, a garage, a vehicle interior, as well as in the area surrounding a large storage facility.

“Every time you talk about safety for hydrogen, you basically consider the consequences of its ignition in air,” says Dr. B nard. “We need to be able to predict typical release patterns and consequences in the specific context of automotive applications (including refueling stations and garages).”

He points out that although hydrogen is perceived as being much more dangerous than other fuels now in widespread commercial use, it nevertheless compares well in this regard.



Dr. Pierre B nard, physicist at the Universit  du Qu bec   Trois Rivi res and leader of the *Hydrogen Safety and Infrastructure for Hydrogen Vehicles* project.

Propane, for example, requires a volumetric concentration of two per cent in air in order to ignite. Hydrogen requires twice this amount for ignition, making it safer from this perspective. And such comparisons will be essential to establishing safe and realistic standards for the design of refueling stations that accommodate hydrogen.

Much of this work is being carried out as part of task 19 on hydrogen safety of the Hydrogen Implementation Agreement of the International Energy Agency (IEA), which acts as a policy advisor for its 26 member countries. The IEA has been formally studying the prospects of hydrogen for almost 30 years, establishing a specific mandate to survey quantitative risk assessment and testing methodologies.

The AUTO21 researchers are also working with counterparts in a European Network of Excellence on hydrogen safety called HySafe, which is dedicated to the safe introduction of hydrogen-based technologies. Dr. B nard observes that a growing number of public and private sector partners are promoting the need for universal standards in this field, reflecting a desire to turn the hydrogen economy from an appealing idea into practical reality.

“It’s seen as a make-or-break step toward replacing our current fuel sources with hydrogen,” he says. “We want to develop a scientific basis for industry practices, because the absence of these kinds of standards will impede the introduction of hydrogen as a fuel, economically and socially.” ■