Zinc Research is Making for Greener, Rust-Resistant Cars

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Joe McDermid, NSERC/US Steel Canada/Xstrata Zinc Industrial Research Chair in Zinc-Coated Advanced Steels (centre), is flanked by representatives from U.S. Steel, Xstrata and the Faculty of Engineering.

Rust never sleeps and, so, neither can Professor Joe McDermid. Prof. McDermid is the NSERC/US Steel Canada/Xstrata Zinc Industrial Research Chair in Zinc-Coated Advanced Steels. His job is to provide corrosion protection for advanced steels that are being made to lightweight the next generation of vehicles so that they are more fuel efficient.

Prof. McDermid, an associate professor of mechanical engineering at McMaster, and academic director of the Initiative for Automotive Manufacturing Innovation (IAMI), outlined work currently underway in the corrosion protection of advanced steels at today's symposium on Partnership in Steel Innovation.

The half-day symposium brought together representatives from U.S. Steel Canada, Xstrata Canada Corp., McMaster Steel Research Centre, and related research areas. In addition to discussing steel and corrosion protection, the event celebrated the extension and expansion of the NSERC/US Steel Canada/Xstrata Zinc Industrial Research Chair.

The chair was initially established in 2003 as the NSERC/Stelco Industrial Research Chair in Steel Product Application with $1 million in funding over five years. In 2008, Xstrata came aboard with an additional $250,000 contribution over five years, which was matched by NSERC. With this contribution, the renewal from U.S. Steel and matching funds from NSERC, the Chair was renamed the NSERC/US Steel Canada/Xstrata Zinc Industrial Research Chair in Zinc-Coated Advanced Steels. Prof. McDermid has been the only chair holder.

Salt-covered, slushy winter streets attest to the need for corrosion protection in vehicles. But the drive to reduce their weight by using thinner sheet steels and alloys, while maintaining structural strength, safety and product durability, has taken on new importance.

"Corrosion protection takes on greater importance for structural integrity and durability of a vehicle when dealing with thinner material," explains Prof. McDermid. "It becomes an essential technology with the new advanced ferrous alloys being developed to further automotive lightweighting."

Lightweighting a vehicle refers to reducing its overall weight in order to reduce fuel consumption and, in turn, greenhouse gas and urban smog-producing emissions. "It simply takes less energy to move less mass," says McDermid.

Zinc has been commonly used for decades to provide metals such as iron and steel with a thin coating that protects against corrosion. Since zinc will corrode preferentially to iron or steel, it will protect iron-based alloys until it completely corrodes away. The coating is applied through either a galvanizing or galvannealing process, where zinc is melted into a molten bath that iron and steel are passed through. These processes are used not only for the metal in car bodies, but also on such things as chain-link fencing, guard rails, suspension bridges, and light posts.

Zinc is the fourth most common metal in use globally, behind only iron, aluminium, and copper. Canada is the world's fifth largest source of mined zinc (710,000 tonnes in 2006) behind China (one-fourth of the global zinc output in 2006 at 2,600,000 tonnes), Australia, Peru, and the United States. Zinc in also used in batteries, alloys such as bronze, and fire retardants. It is what makes white paint white and is an important nutritional supplement.

“McMaster has one of the best equipped academic labs on the planet for studying zinc coated steel, and the steel research centre structure ensures that research work is timely and relevant to industry,” said Martin Gagné, Manager, Product Development, Xstrata Zinc Canada Division

A new state-of-the-art galvanizing simulator was recently acquired to aid in corrosion protection research. It is one of only three machines located in academic institutions worldwide and the only simulator located in a North American university.

The renewal term for the industrial research chair is allowing 11 graduate students and post doctoral fellows to pursue studies and research in corrosion protection.