

# Ideas on the Edge

## Sparking Sustainable Steel

ELECTRIC ARC FURNACES PRODUCE NEW STEEL FROM SCRAP METAL. NOW GORDON IRONS AT MCMASTER UNIVERSITY WANTS TO MAKE A GOOD THING WORK EVEN BETTER.



“Steel is the most recycled material in the world,” explains Dr. Gordon Irons of McMaster University, “and much of it goes through electric arc furnaces. But despite the fact that almost half the world’s steel is made this way, we don’t have a really good understanding of what’s going on inside those furnaces.”

In conventional steelmaking, iron ore is fed into furnaces that use blasts of super-heated air to turn the ore into molten iron, and then into separate furnaces for steelmaking. An electric arc furnace, by contrast, is fed with scrap steel, and the main heat source is an electric arc created between electrodes within the furnace.

Large-scale blast furnace technology dominated steelmaking until the 1960s. But then, the growing availability of scrap steel created an opening for smaller operations—known as “minimills”—built around the smaller electric furnaces. Minimills are cheaper to operate, and don’t require access to coal and iron ore. All that’s needed is enough scrap and lots of electricity.

The market share for steel made this way has been steadily growing. “But there’s very little fundamental research being done on how the process works,” says Dr. Irons. “The minimill companies don’t tend to be large enough to do research, and don’t associate much with universities. But now, with our Centre, that’s changing.”

Dr. Irons is Director of the McMaster Steel

### RESEARCH THAT MATTERS REAL-WORLD BENEFITS FOR ONTARIANS:

- new technologies to keep Ontario’s steelmakers competitive
- applied research with impacts all across Ontario’s key manufacturing sector

## Sustainable Steel, Sustainable Research

Twelve member companies from around the world help support the Steel Research Centre at McMaster. "They pay a membership fee and we use that to run our projects," explains Centre Director Gordon Irons. "Then we go to the federal and Ontario governments to match the funding, so we double the membership's leverage."

In exchange for their participation and support, the member companies each have a royalty free licence to technology developed at the Centre in their operations. "We're into our second five-year cycle now," says Dr. Irons, "and the strong funding from industry makes us sustainable."

Research Centre, created in 2000 to pursue advanced applied research in the area of steelmaking. The Centre has numerous industrial partners, including the giant Dofasco. But research into electric steelmaking has also attracted the participation of a number of minimill companies. They're interested in what Dr. Irons and some of his colleagues are learning about the fundamental chemical processes that take place inside an electric arc furnace. That knowledge promises to improve the quality of the resulting steel and reduce environmental



McMaster  
University  
Hamilton

**Project:** Advanced Steel Processing Laboratory  
**Institution:** McMaster University  
**Research Discipline:** Engineering/Materials Science and Technology  
**Principal Investigator:** Gordon Irons  
**Trust Investment:** \$1,017,928  
**CFI Investment:** \$1,017,928  
**Total research investment from all sources:** \$2,544,820

impacts. "This research is important now and for the future," says Dr. Irons, "because we're going to need sustainable steel making processes that ensure we use fewer resources, and create less carbon dioxide."

The Centre's facilities, funded in part by an investment from the Ontario Innovation Trust, include a suite of advanced test instruments, as well as scaled-down versions of industrial furnaces and a sophisticated piece of equipment that can simulate several kinds of galvanizing. Galvanizing—the application of a protective layer of zinc to steel—is another key area of study.

Dr. Irons emphasizes that research at the Centre is both advanced and applied. "What we're doing here is building the bridge between fundamental processes and how you can improve them to make new products....We talk about the 'information age,' and that we're beyond manufacturing, but I don't really think that's the case in Ontario. I think manufacturing is going to continue to make Ontario prosperous. That's why we need people who are educated to work in these sectors, and not just at a technical level, but at a highly innovative level."



MaRS Centre, Heritage Building  
101 College Street, Suite HL20  
Toronto, ON M5G 1L7  
416-977-9188 Fax: 416-977-9460  
innovation@oit.on.ca  
www.oit.on.ca

## Infrastructure for Innovation About the Ontario Innovation Trust

The Ontario Innovation Trust was created in 1999 by the Government of Ontario to invest in research equipment and facilities at Ontario's universities, colleges, hospitals and other non-profit research institutions. The Trust is governed by a volunteer Board of Directors, according to the terms of a Trust agreement established by the Ontario government. A small permanent staff looks after day-to-day operations.

Since its inception, the Trust has committed almost \$843 million to strengthen Ontario's position in the global marketplace of ideas. This represents more than a third of the \$2.44 billion in total funding that has been invested in Trust-supported projects.