‘Green steel’ from old rubber tyres produces no waste or toxic fumes

The ‘impossible’ achieved through deep collaboration between Centre for Sustainable Materials Research & Technology and OneSteel

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The seemingly impossible dream of producing steel with the help of recycled materials such as old rubber tyres and plastics is now a reality thanks to close researcher-industry collaboration.

University of New South Wales researchers and OneSteel Ltd collaborated through the Centre for Sustainable Materials Research and Technology (SMaRT) to achieve the breakthrough, which replaces a significant proportion of the coke normally used in EAF steel-making with recycled tyres or plastics that are rich in carbon.

“The really exciting side benefit was that the recycled scrap rubber or plastic material produced a more stable foamy slag compared to using coke only,” says Professor Veena Sahajwalla, Director of SMaRT at the UNSW. “This greatly improves the steel furnace’s energy efficiency.”

The technology has been successfully incorporated into OneSteel’s commercial furnaces over the past four years and is now standard practice at two of its Australian operations.

The process, called Polymer Injection Technology has been patented internationally and has been commercialised for international steel makers using Electric Arc Furnaces (EAF), responsible for 40 percent of the world’s steel production. The first commercial implementation of the technology took place in Thailand in 2011.

Professor Sahajwalla hypothesised that if recycled rubber or plastic was subjected to rapid and very high temperatures it would change into the carbon material that joins with molten iron to make up steel along with clean gases such as hydrogen and carbon monoxide.

She successfully tested this in her UNSW lab by injecting the rubber/plastic into a mini EAF using the same processes by which coke is injected.

“While this research was groundbreaking, it would likely have just ended up in journal papers if it hadn’t have been for our collaboration with OneSteel,” Professor Sahajwalla says.

“Not only did this collaboration provide access to industrial-scale furnaces essential to proving the real-world viability of the process, but OneSteel as experts in technical and commercial steelmaking took an active role in improving the process over hundreds of test melts.”

During the collaboration, many SMaRT centre students worked within OneSteel’s facilities resulting in some joining the company during and after the collaboration, and bringing young engineers into an industry that can struggle to attract top talent.

As of March 2012, the technology has replaced almost 15,000 tonnes of coal with more than one million car tyres (or their equivalents). This has reduced many millions of KWh hours of energy each year while increasing furnace productivity and producing more steel from the same amount of ferrous scrap.

The Polymer Injection Technology Technology won a 2012 Collaborative Innovation Award tonight at the Cooperative Research Centres Association conference in Adelaide.

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