

Scrap consumers knocking at ReSteel's door

It is an age-old point of discussion between the steel industry and its suppliers: how to keep copper contamination in scrap within acceptable bounds. New start-up company ReSteel believes it has found a patented solution that will reduce copper levels to below 0.1%. 'This will phase out the entire hand-sorting way of selection,' proclaims Professor Peter Rem of the Delft University of Technology's Faculty of Civil Engineering and Geosciences.



An excessive level of copper in steel scrap undermines the confidence in scrap as a raw material.

Enthusiastic scientists and entrepreneurs are starting up a separation technology company from scratch, using a top-secret technology which has just entered its commercialisation phase. But steel manufacturers are already knocking on the door of this newly-formed spin-off company from Delft University of Technology in the Netherlands. 'Currently, I am very busy interviewing people,' says ReSteel's CEO Kees de Waard.

The problem of copper in steel scrap is well known to recyclers and steel producers: even after hand-picking, the red metal can be

present in unattractively high levels. Excessive contamination of the melt causes new steel to be either too soft or too brittle, making it unsuitable for its intended purpose. According to steel producers, this problem undermines their confidence in scrap as a raw material.

In steel originating from the household refuse stream and e-scrap, copper contents average respectively 0.6% and 1.6%. 'That's much more than the 0.1 or 0.2% a steel producer wants,' says Professor Peter Rem. Even with hand-picking, he adds, pieces of copper can be missed given that this represents a human activity and is therefore subject to errors. This internationally-renowned specialist in separation techniques at Delft University of Technology's Faculty of Civil Engineering and Geosciences forms the backbone of this research project. He states: 'The machine we have developed can completely replace the last manual step in recycling, lowering the copper content to almost nothing.'

Considering alternatives

'We have reached a momentum,' says Prof. Rem, 'that steel producers are seriously considering alternatives to using steel scrap because it is too contaminated.' The presence of copper is not limited solely to scrap: even raw steel comprises a certain proportion of this base metal. Over recent decades, steel producers themselves have tried to find a method for separating the copper from the steel - but without success.

Ten years ago, researchers in Japan looked to calculate the point at which copper contamination would reach an unacceptable level. And that critical moment has now arrived - a factor which provided the main motivation for the founders of ReSteel.

Four years ago, Prof. Rem and his colleagues began extensive research into the specific properties of steel and copper, and identified differences which have led to the development of their new technology. He says: 'In the back of my mind, I always kept the question: "What



Prof. Peter Rem from the Delft University of Technology.

will this machine look like?" In general, you can easily determine a lot of specific properties, but often you cannot translate this into an active separation technique.'

There was to be a 'Eureka' moment for him and his co-workers when results highlighted that a cheap, low-energy and functional system could be adopted to reduce copper content in steel to less than 0.1%. While the research team is understandably reluctant to provide too many details about the separation system, the following extract from the patent application offers some insight:

'The invention relates to a process and device for the separation of fragments of liberated ferrous scrap from not liberated ferrous scrap fragments by means of a static magnet, wherein a mixture of said liberated ferrous and not liberated ferrous fragments is fed onto a continuous conveyor belt which is driven around drums and wherein said magnet is fixed in the drum distant from the feeding point, wherein a magnet is used which is preferably a dipole magnet having magnetic field lines in the separation zone predominantly parallel to the belt surface.'

Tested in the field

'The world's steel industry currently produces 1.3 billion tonnes of steel, which amounts to 200 kg per person a year - an enormous quantity,' ReSteel points out. 'When you realise the

Prof. Peter Rem: '...steel producers are seriously considering alternatives to using steel scrap...'

scale of the market, and the importance and cheapness of our solution, I believe it can have an enormous impact,' insists Prof. Rem. Several prototypes of the ReSteel sorting system have been tested at two major scrap processing facilities in the Netherlands. It combines three different - and very well protected - processes configured in a de-centralised way. The developers are claiming that the system not only extracts all copper-contaminated scrap particles as well as other types of waste that are accidentally pulled out by magnets, but also selects

steel according to its different qualities. The process segregates thick-walled scrap, thin-walled scrap and scrap contaminated with copper and stainless steel.

In the laboratory, the researchers have tested the technology on different metal waste streams, including end-of-life vehicle material, used electronic equipment and household refuse. Whether in electronics, vehicles or any other form of steel, the number of items in which copper is connected to steel has increased substantially over recent decades - for example, in the small electrical motors used for car windows. 'When you are in the early stages of a research project, you have no idea what the results will be; you just have a model in mind of what might be possible,' explains Prof. Rem. 'By testing it in laboratory situations, you really get hands-on with it.' And he continues: 'As a steelmaker, you want to have a guarantee that there will be no copper in the scrap. That is what a mechanical solution can offer in preference to hand-sorting.'

Interest all round

The new system offers an opportunity both for scrap suppliers and consumers, according to ReSteel. 'If you consider the reactions after our first announcement, we were being contacted by recyclers and steelmakers,' notes Mr de Waard. According to the ReSteel team, the results derived from prototype testing have actually exceeded their expectations as the steel scrap was shown to be really clean. Two separation systems have ultimately been developed: one capable of processing 20 tonnes per hour and the other 40 tonnes.

'It is quite easy to increase the capacity of the system,' explains Peter Westerhuijs, responsible for business development at Delft University of Technology.

Background to ReSteel

ReSteel was formed when private equity firm Icos Capital - a Dutch clean-tech investor - came up with a multi-million Euro funding package. Icos is currently the major shareholder in the initiative along with Delft University of Technology. For the university, the ReSteel venture



Artist impression of ReSteel's separation technology.



An example of copper rich content extracted through the ReSteel system.

has proved to be unique since it was established without any industrial co-operation prior to Icos Capital stepping in.

Nityen Lal, General Partner at Icos Capital, comments: 'ReSteel's business proposition is at the heart of the climate change and resource scarcity issue. By recovering high-quality steel, copper and other metals, ReSteel can help increase the supply of base metals locally at competitive cost.' The funding from Icos will be used to finance ReSteel's European roll-out. From its research base at Delft and its commercial offices at Sliedrecht, also in the Netherlands, ReSteel is responsible for the design, final assembly and commercial operation of the copper extraction machinery. The company is the fourth to be spun off from Delft University of Technology's Faculty of Civil Engineering and Geosciences, earning Prof. Rem an award as the 'most entrepreneurial scientist'.

According to Prof. Rem, his faculty will come up with further separation innovations in the near future. □

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