PAROC-WIM, (LIFE02 ENV/FIN/000328)

Waste Injection into the Melting Furnace in Stone Wool Production

Paroc has developed a process, PAROC-WIM, to feed fine fractioned material directly into the melting zone in a stone wool melting furnace. The name of the process comes from words Waste Injection into the stone wool Melting furnace. Optimum environmental benefit of this process is gained when it is used for recycling stone wool production waste directly into the melting zone. In addition other fine fractioned minerals and especially fine fractioned coke can be fed into the melting furnace with WIM.

Paroc's innovations and own manufacturing technologies are guided by the sustainable development bearing in mind recyclability and the positive environmental effects of stone wool.
**Background**
The total waste generated in the European stone wool industry is estimated at 20 to 60% of product output. In practice this means 160,000 to 480,000 tons of waste in the EU from 40 production lines with in average 20,000 tons/line yearly production. The major part of the waste comes from the fiberizing process. When the spinning machine turns molten material, a mixture of different types of rock, into fibre about 10-20 % of melt is not completely turned into fibre and consequently rejected from the production process. A stone wool line with a yearly wool production of 20,000 tons generates 2,000 to 4,000 tons of fiberizing process waste per year. Until now there has been only one method to re-use this waste. The waste has been grinded and mixed with cement to make briquettes. The briquettes are hardened before use as a raw material in the melting process, acting in the same way as rock. Making waste into briquettes requires rather high investment costs in the form of machinery and building. Melting briquettes containing cement causes higher atmospheric emissions of particulate matters and sulphur oxides than melting virgin rock due to the impurities in cement.

**Technical solution**
With the PAROC-WIM it is possible to inject the waste resulting from the fiberizing process, sized between 0 - 6 mm, directly into the melting zone within the cupola. The waste is transported to a hopper and a pressurised feeding tank on load cells about 10 m above. In the bottom of the tank there is a rotating feeder, which feeds small doses of material into three pneumatic feeding pipes. Lances connected to the cupola close to the tuyères are placed at the end of the pipes. The material moves through the lance where oxygen is added into the melting zone in the cupola furnace. The machinery is exposed to an extremely harsh environment. Temperature in the melting zone is above 1700 °C, at the same time the materials which are fed in are hard and abrasive, which puts a significant strain on the materials and the machinery design.

For further development other finer fractioned raw materials and solid fuels can also be injected in the same manner as demonstrated. For example, finer fractioned coke and mineral raw materials can be fed via the waste injection equipment into the melting furnace.

**Environmental and economic benefits**
Waste injected into the melting furnace has doubled from the 50 kg of waste per ton of product at the beginning of project to 100 kg. When some raw materials are replaced with "pre-melted materials", the melting energy consumption is reduced remarkably.

In the Oulu prototype the use of coke has been reduced by 8 %, when about 7 % of raw material is replaced with production waste.

In Hässleholm, a full-scale machinery factory has seen a greater reduction in coke consumption than the prototype. When replacing about 5 % of pure raw material with production waste, the use of coke has been reduced by more than 10 %.

The reduction of coke consumption generates a significant saving in the melting costs as well as a decrease in the emissions of carbon dioxide and sulphur oxides. In comparison with the other known way to recycle fibre process waste as a
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Technology/Technical development
The 3. PAROC-WIM project has been carried out in two Paroc factories; in Oulu, Finland and in Hässleholm, Sweden.

Oulu
The prototype at the Oulu factory has been improved taking account of the limitations of the existing design and location of the machinery. New materials and a new design have been tested and the best solutions are implemented in the problematic machine components. Working routines have been developed in order to utilise the machinery in the optimal way.

In 2003 almost 80 % of the spinning waste was reused as raw material corresponding over 7 % of the total amount of mineral raw materials.

Hässleholm
A totally new full-scale pilot plant has been constructed and placed at the stone wool factory in Hässleholm. The best elements of the prototype have been used in the pilot plant, in both the design and operational routines. During 2004 the use of spinning waste recycling has increased from 80 % to nearly 100 %.

Technical and commercial application
The final objective is to implement this technology in other Paroc factories and make it available for the other stone wool producers through the commercialisation of this technology.
**Application possibilities**
The waste injection technology is applicable in the stone wool manufacturing industry where cupola furnaces for melting stone material are used. In comparison with the waste recycling technology presented in BAT Reference Document for glass industry, i.e. making briquettes, WIM is superior because it combines waste reduction with a reduction in air emissions.

**Relevance to the EU legislative framework**
EU environmental policy emphasises waste reduction and the reduction of green house gases. Waste injection can offer a cost effective way to meet the requirements in the stone wool manufacturing industry.

**WIM provides environmental benefits in production of stone wool**
- Reduces land-filling of waste from production process
- Reduces energy consumption by reducing the use of coke
- Reduces gaseous emissions caused by coke combustion
- Saves natural resources (virgin rock, coke)
- Opens up possibilities to use new fine fractioned raw materials and fuels

Paroc Group is one of the leading manufacturers of mineral wool insulation products and solutions in Europe. Paroc products include building insulation, technical insulation, marine insulation, structural stone wool sandwich panels and acoustics products. We have production facilities in Finland, Sweden, Lithuania, Poland and Great Britain. We have sales and representative offices in 13 countries in Europe. Our net sales for 2003 amounted to EUR 288 million and we employ 1,860 people.