

Company:

Fricke und Mallah
Microwave Technology GmbH
Werner-Nordmeyer-Str. 25
31226 Peine
Germany

Tel. +49 5171 5457 0

info@microwaveheating.net
www.microwaveheating.net

Products:

Tunnel Ovens
Chamber Ovens
Laboratory Ovens
Solid State Technology
Generators
Magnetrons

Applications for:

Wood Industry
Food Industry
Ceramic Industry
Chemical Industry
Plastic Industry
Microwave Plasma
.... and many more

Benefits:

Consulting and Support
Research and Development
Practical Process Design
Simulations with CST Studio
Service worldwide

Electronic waste represents a significant part of the waste that can be recycled. Every year, about 50 million tons of it are generated worldwide. Valuable materials that can be recovered as secondary raw materials are also of interest to industry. On the other hand, it contains a large number of highly toxic and environmentally hazardous substances that are released during recycling. This is one of the reasons for a relatively low recycling rate of 20% (in Germany 2.4 million tons / 43% recycling rate). New recycling processes are needed to meet the politically prescribed collection rates and to achieve the long-term goal of 100%. One of the most promising approaches is pyrolysis, as this produces a highly copper-rich concentrate and high-quality by-products.

Challenge

A new process has to be developed for the resource-efficient recycling of circuit board scrap by means of microwave pyrolysis in rotary kilns and the necessary plant technology to enabling a recycling rate for circuit board scrap in Germany of up to 100%. The task is to produce a metal concentrate containing copper and precious metals with a metal content > 45 %, a combustible pyrolysis gas with a calorific value > 18 MJ/m³, carbon and an ash, which can be used e.g. in the cement industry and the reduction of the slag to be treated or waste to be disposed of in the copper process by a good 50 % by using a high metal concentrate.

Solution

Fricke und Mallah and the institutes „Metallurgische Prozesstechnik und Metallrecycling“ and „Industrieofenbau und Wärmetechnik“ of the RWTH Aachen have developed a laboratory device for increasing the energy and resource efficiency of recycling of organic-contaminated electronic scrap (aluminium). The Microwave Pyrolysis Rotary Oven comes with 8 Generator with 6 kW each and works with magnetron technology and 2455 MHz. The operating temperature is up to 1000° C. It includes an outer, gas-tight and fixed jacket housing that reflects microwave radiation and holds it in place and an inner, gas-tight rotary tube, transparent to microwave radiation, in which the goods are transported. Connections for introducing and extracting nitrogen is also included.

**Benefits**

A high energy efficiency was achieved in the coupling of thermal energy compared to conventional, gas-heated rotary kilns, since at least 80% of the microwave radiation is converted into thermal energy directly in the volume of the material, which means that the entire rotary kiln does not have to be heated. The throughput of the plants on an industrial scale for this process is ≥ 0.25 t/h. The system achieves up to 7 times higher heating rates compared to conventionally heated rotary kilns and thus avoids unwanted pyrolysis oil.

Furthermore, measurement and control technology adapted to the new process was developed to ensure trouble-free operation of the entire plant.