

FRAUNHOFER INSTITUTE FOR ENVIRONMENTAL, SAFETY AND ENERGY TECHNOLOGY UMSICHT, INSTITUTE BRANCH SULZBACH-ROSENBERG

iCycle[®]-Technology for treatment of electronic scrap



Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT

Institute Branch Sulzbach-Rosenberg An der Maxhütte 1 92237 Sulzbach-Rosenberg

Dipl.-Ing. Katharina Reh Head of Department Recycling Management Phone +49 9661 8155-431 katharina.reh@umsicht.fraunhofer.de

Dr. rer. nat. Alexander Hofmann Head of Department Recycling Management Phone +49 9661 8155-435 alexander.hofmann@umsicht.fraunhofer.de

www.umsicht-suro.fraunhofer.de www.fraunhofer.de

Metal recovery from electronic scrap

The iCycle[®]-Technology was developed to recover precious metals from electronic scrap and shredder residues thereof. The process is based on a thermo-chemical conversion under the absence of oxygen. Thus, a sufficient disintegration of metals from plastics is enabled without oxidation. The revealed mixture of char and metals can directly be fed into integrated copper smelters enabling the recovery of up to 20 single metals from the mixture. At the same time, the plastics, that are converted into oil and gas (pyrolysis gas) under the given process conditions act as energy carrier for the self-sufficent operation of the plant and, if desired as a source of valuable chemical building blocks that can be isolated in downstream process (chemical recycling).

Keywords

- Treatment of different WEEE-fractions including shredder residues
- Accumulation of precious metals for centralized recovery in e.g. integrated copper smelters
- Production of liquid and gaseous fuels
- Treatment of mixed and contaminated (e.g. halogenated flame-retardants) WEEE-fractions

Industrial sectors

- WEEE-Treatment
- Plant Operators
- Metal Recycling
- Remelting and Refinery
- Plastics Compounding







Schematic of the pyrolysis reactor

Various WEEE-feedstocks tested in iCycle[®]

Features and development of iCycle® technology

Unique features

- Patented continuously operated auger reactor ensuring optimum process conditions by permanent wall contact of the feedstock and precisely adjustable retention time and heat supply to the feedstock
- Patented combined heat exchanger system enabling heat-supply via the surface of the auger reactor and via the inner section of the auger reactor by a cycled spheres heat exchanger
- Prevention of clogging of feedstock to the heat exchanger by indirect heat-transfer
- Prevention of tar-formation and clogging of condensation untis by innovative cleaining unit
- Rapid ramp-up of temperature in order to skip temperature ranges critical to the formation of Dioxines and Furans
- High process stability and plant availability
- Temperature up to 700°C, adaptable retention time of feedstock
- Flexible scaleability from 70 kg/h up to > 5t/h
- Low pre-treatment requirements

Implementation and commercial application

- iCycle[®] can be implemented highly flexible in existing plant configurations for WEEE-dismantling and recycling
- If new WEEE-dismantling and recycling facilities are planned, iCycle[®] allows significantly reduced mechanical pre-treatment efforts apart from manual dismantling and pre-shredding

As soon as commercial application of iCycle[®] is desired by our customers we can offer:

- Know-how transfer and support during implementation and commissioning
- Mediation of contacts to Fraunhofer Spin-Offs as licensees and cooperation partners
- Direct exclusive or non-exclusive License agreements for construction and operation of iCycle[®] units for different feedstocks and countries
- Mediation of experienced EPCC partners for scale-up and construction of iCycle[®] units

Opportunities for cooperation

The services of Fraunhofer UMSICHT as a governmentally funded non-profit organization are limited to research & development. This covers:

- Execution of test trials with customer specific feedstocks
- Development and Construction of new or adapted solutions according to customers needs
- Preparation of feasibility studies (technical, economical, ecological)
- Joint research and development
- Education and training



Cooperation with Fraunhofer

Your benefit in working with Fraunhofer

- The Fraunhofer-Gesellschaft, headquartered in Germany, is the worlds leading applied research organization
- Founded in 1949, the Fraunhofer-Gesellschaft currently operates 75 institutes and research institutions throughout Germany
- The majority of the organization's 29,000 employees are qualified scientists and engineers, who work with an annual research budget of 2.8 billion euros
- Of this sum, **2.4 billion euros** are generated through contract research
- Fraunhofer Institute UMSICHT looks back at more than 20 years of experience in thermo-chemical process engineering
- Fraunhofer UMSICHT accompanies you all the way from planning until commissioning and training on-site



For more information, please visit: www.umsicht-suro. fraunhofer.de/en/ Our Solution/iCycle