

MICROWAVES IN ASBESTOS NEUTRALISATION TECHNOLOGY

ATON - HT SA 50-421 Wrocław, ul. Na Grobli 6, POLAND

The development of civilisation is accompanied by a rapid growth in "production" of various kinds of waste, including hazardous wastes which are of a serious threat for the natural environment and directly a threat to people. Nowadays this increasing threat has become so noticeable that all developed countries in the world are taking up efforts to neutralize the threat or at least minimize it. Unfortunately substantial part of this waste is still being buried in previously prepared storage sites, what in a case of hazardous wastes that are not undergoing fast biodegradation, is not a solution that would neutralize the threat. By doing so, the problem of neutralization of the threat is left to next generations. Vast areas of land are transformed into waste dumps, which even after careful recultivation might be still a potential threat for the natural environment.

Asbestos utilisation procedure is the best example of proving the short-sighted approach towards waste neutralisation. It is worth mentioning the scale of this problem. Asbestos is a very harmful for people, being inter alia the reason for so called asbestosis (incurable lungs disease). In Poland the existence about 15 million tonnes of asbestos waste (eternit panels) has been officially registered.

According to Polish legal regulations the procedure of asbestos utilization concerns only burring it in previously prepared storage site this is regulated by so called Asbestos Act. The Act also outlines principles on disassembling of eternit panels, securing them by wrapping with special foil, regulations concerning transportation and procedures of burring them at storage sites.

Scale of the problem related with removal and neutralization of asbestos containing waste is enormous and likewise in other countries where huge quantities of such waste can be found, it is indispensable to carry researches and introduce other methods of neutralizing asbestos. Such a tendency is currently noticeable in many developed countries (for example in Switzerland and Great Britain), where asbestos is dug out from storage sites to be neutralized with appliance of other physical and chemical methods. Nowadays, also in Poland due to favouring technical and economical conditions, implementation of procedures aimed at neutralization asbestos is possible by appliance of the new method, namely **Microwave Thermal Treatment method (MTT)**, which was developed and implemented in Poland.

MTT method:

The essence of the technological solution, developed and introduced by company **ATON-HT SA** based in Wrocław, consists in thermal destruction of hazardous asbestos fibres by heating them up with microwave energy. In these method, protected by patent application in the country (P-377957) and abroad (PCT/PL2006/000075), eternite and other waste consisting asbestos, after preliminary crushing (in a crushing machine of special hermetical construction) is mixed with small quantities of assisting substances and inserted to the chamber of microwave reactor. As a result of heating up of the mixture, up to the temperature of approximately 900 - 1100°C, fibre structure of asbestos gets transformed into non-fibrous form.

Transformation of the physical structure of asbestos, due to micro-wave thermal treatment (MTT method) is shown in the pictures below.



Chrysotile serpentine asbestos



Asbestos fibres in crushed eternit



Pictures of fibres and ATONIT

ATONIT - output product of eternite in microwave reactor - MTT technology

Characteristic feature of the developed method is 'contactless' heating of hazardous wastes by properly concentrated microwave energy beam up to the level of required temperatures, in controlled and optimal for the process gas atmosphere. Such possibilities are impossible to achieve by conventional heating methods.

It is important to mention, that discussed method due to appliance of appropriate aiding substances the process of microwave absorption by crushed waste is improved, practically irrespective of its content and the temperature of full transformation (destruction) of hazardous asbestos fibres is lowered. This is of decisive importance in obtaining full efficiency of transformation of all asbestos fibres into a safe material and also for improvement of process energetic efficiency.

Procedure described above is presented in a diagram of technological process (Figure 1). The details of ATON 200 construction are shown in fig. 2.

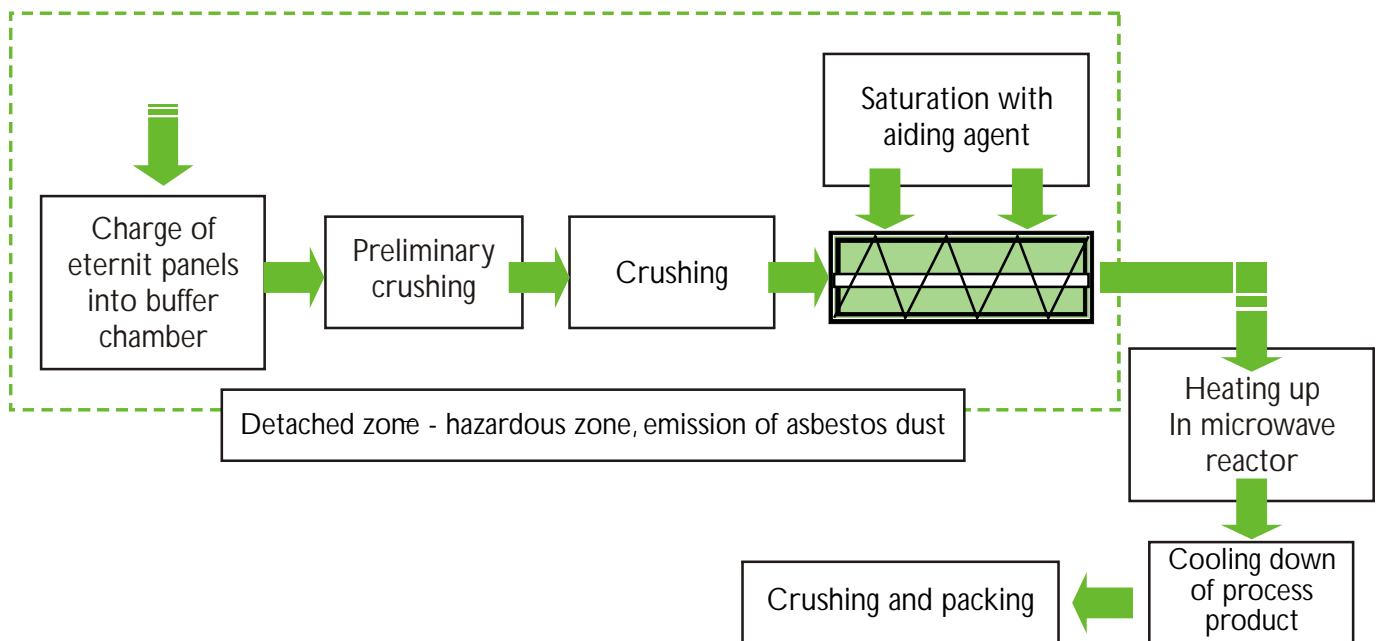


Figure 1. Block diagram of thermal system for utilization of waste containing asbestos.

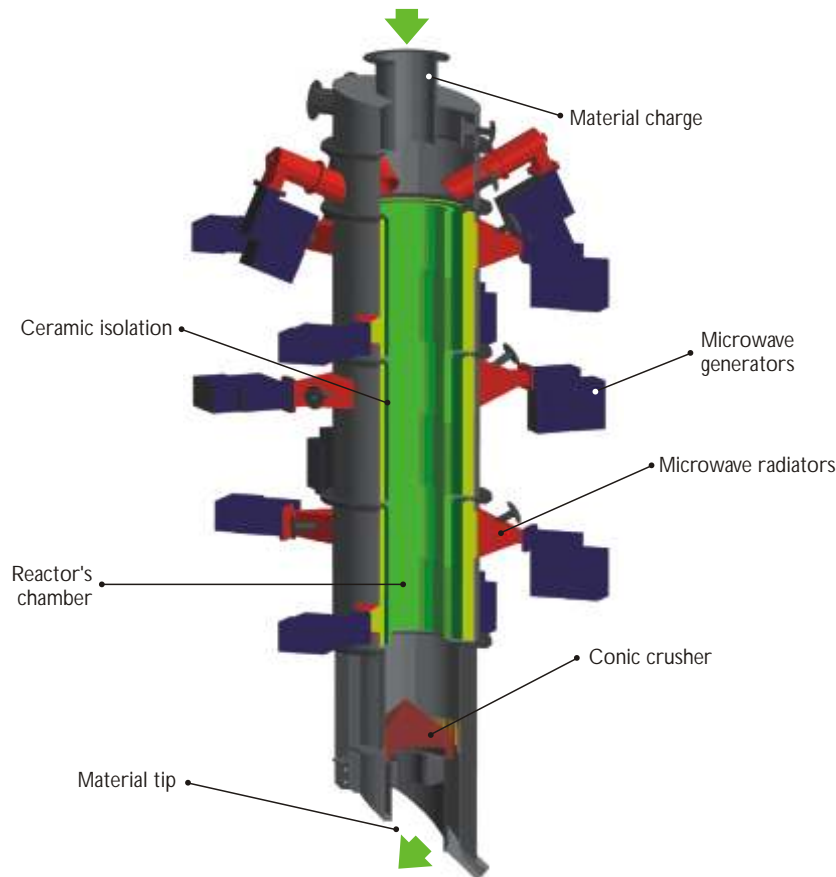


Figure 2. Construction of ATON 200 reactor for asbestos waste neutralisation.

Microwave radiators installed on outer reactor's walls are combined with microwave generators and emit concentrated beams of microwaves into material which is slowly moved up to down inside reactor. Process of heating up waste by microwaves is controlled by the system of temperature sensors - pyrometers and thermocouples. The solid residues (pumice-like material) is grinded with conic crusher of variable rotation speed located at the bottom of the reactor. It enables control of the process rate inside the reactor. The whole process is operated automatically by suitably programmed controller.

Process is wasteless: output residue material has a trade name - **ATONIT**. It is not toxic, is completely fibres free and might be used as concrete additive, in production of pitches, road construction technologies, etc. It is also worth mentioning that ATONIT is admitted to trade and has all the required certificates of Institute for Construction Techniques, Institute for Health and Safety and National Occupational Health and Safety Institute.

During thermal treatment of eternit panels or other asbestos containing materials, water vapour is released and small quantities of other volatile substances from contaminations that might be found on eternit panels, such as various paint coatings, oils and organic contaminants (flies, lichens). Despite usually trace emission of potentially hazardous substances, reactors were equipped with conventional gas cleaning catalytic systems or optionally with an innovative system for after combustion of exhaust gases called **MOS**, developed by **ATON-HT SA**.

Due to specific storage characteristics of asbestos waste and for elimination of difficult transportation of large quantities of hazardous waste, a special technological line, installed in two mobile containers was constructed. Devices used for crushing eternit panels, mixer and a special system for transportation of hazardous material to the reactor are located in the first container. Reactor's chamber with microwave sys-

tems and control systems are located in the second one. Containers may be easily transported and used in vicinity of the eternit panels' disassembly site, in a way that would minimize risks related with dislocation of hazardous waste.

Build-up device can neutralise and process within an hour approximately 200 kilograms of eternit. The device needs electrical power to function. Power must be provided from local supply network 3 x 400V, or in case of lack of access to power network, power generating set might be also used.

Summary:

Based on few years of research and development works, a new innovative technology - **MTT**, for efficient neutralization of hazardous asbestos containing waste was developed. This technology might be a valuable supplementation for currently used procedures of burring asbestos waste or even in a relatively close future will enable complete elimination of asbestos storage method. The most crucial characteristic features of the proposed solution:

- Implemented technology is completely safe for the environment and operability of devices.
- Neutralization process of asbestos waste might be carried at the site or in vicinity of storage area, what eliminates necessity of arduous and ex-pensive transportation and is fully in accordance with EU regulations.
- Process is completely waste free - final output is a useful product, which might be reused in construction industry, including road building industry. This output material might be used locally, in vicinity of places where neutralization process is carried.
- Cost of MTT technology is very competitive - in comparison to eternit storage method. Depending on local conditions, including variable costs of electricity, the total cost of neutralization of 1 tonne of eternit would be from 100 up to 150 euro.
- Quick application of MTT technology may help solve many crucial problems and threats, both on a local and national scale. Resignation from constructing another waste storage sites and introduction of limits or even complete elimination of special transportation of waste, except for costs reduction, is of a general public interest - because local communities protest more and more effectively against construction of such storage sites in their region.

Briefly described **MTT technology** - based on application of microwave energy, except from usage in neutralization of asbestos containing waste, might be also applied in environment protection. Thanks to **MOS** device (mentioned above), designed for after combustion of contaminants in reactor's exhaust gases and after combustion of contaminated gases from other devices and systems. Currently, innovative construction of microwave reactor with rotary drum undergoes final tests. This device is designed for heating of contaminated ceramic catalysts used in petrochemical industry. Another innovative technology of carbonization of organic waste is in implementation stage. This technology will be widely used in neutralizing waste in meat processing plants, poultry processing plants or for utilization of veterinary medicine waste, sewage sludge, etc.

Results obtained so far, confirm that microwave energy that enables 'contactless' heating up of various organic wastes and special ceramics, leads to creation of unique technological possibilities that could be used for conduction of various processes of thermal treatment of hazardous materials and may also be applied in various new applications related with environment protection.



CASE STUDY

Technical data

Capacity	200 kg/h (ethernit)
Power supply	3 x 400 V, 80 kW
Water cooling	close loop
Process residues	fiberless mineral material, may be used in construction industry
Exhaust gases	air with water vapour
Options	•MOS and/or catalytic system for exhaust gases treatment •special grinder for soft asbestos waste
Mechanical construction	two hermetic mobile containers
Process	automatic with microprocessor control