

1. Project title:

Technology for neutralizing dangerous waste by capitalizing it in vitreous materials and vitreous – ceramic materials

2. Proposal's acronym:

RECWAS

3. Project number : PN II

32133 / 01.10.2008

4. Scientific and technical project presentation:

At present, in our country, the waste / dangerous waste constitute an important environmental pollution source due to the fact that their storage and stocking are made improperly.

The dangerous waste can generate point or diffuse discharges of one or several dangerous substances provided in G.D. 351/2005 concerning the approval of the Program for gradual elimination of discharges, emissions and losses of priority dangerous substances, taken from the Community environmental acquis.

The dangerousness level determination of a waste is regulated by Order no. 95/2005 which transposed the European Council Decision on 19 December 2002, related to preliminary criteria and procedures for accepting the waste storage, according to Article 16 and Annex II of Directive 1999/31/ EEC.

Quantitatively the dangerous wastes containing metals generated by ferrous metallurgy and metal – working industries, resulting from dangerous waste incineration, waste water, treatment plants, have generally a relatively high weight in the balance – sheet of waste produced in Romania and its storage represents a problem which should be solved.

At international level, different treatment/neutralization techniques and methods have been elaborated for dangerous waste depending on contained dangerous substances in order to capitalize and/or dispose it finally by storage. According to the prevalent content (organic or inorganic) of dangerous waste, proper treatment/capitalization methods have been set up. Thus, for the waste with a prevailing organic content, the neutralization methods are based on incineration and co-incineration. For those with a prevailing inorganic content (particularly metal compounds) the methods rely upon physic-chemical immobilization process in binding systems.

The materials like glass or vitreous-ceramics are known to be very stable chemically (glass objects found on archaeological sites, thousands of years old present negligible alteration traces). This argument led to glass use for

including some toxic substances in order to eliminate their storage and risk of their spreading in the environment.

France was the first country that developed an industrial plant to include dangerous waste (nuclear) in a vitreous matrix. Germany followed in 1985, then Russia in 1986, Great Britain in 1991, Japan in 1995, U.S.A in 1996 (set into operation two plants at Savannah River and West Valley).

Concerning the capitalization by including in a vitreous matrix certain dangerous wastes containing metals, the results of the following European companies are known: Alstom, Euro plasma, EDF, R&D, etc. The obtained products are stable, with no ecological risks and they can be converted, by different processing methods in marketed products.

The vitrifying process requires to monitor and correct the chemical structures of fusions before and after vitrifying and to control rigorously the final products features which are stable for a long time and use.

Generally, for including the dangerous waste in a vitreous matrix the following manufacturing parameters should be taken into consideration: elaboration temperature, viscosity, homogeneity, elements volatility at elaboration temperature, furnace refractory corrosion etc.

Not all the elements existing in wastes could be included in glass (inclusion difficulties of waste containing elements such as molybdenum, plutonium, ruthenium etc, are well known) and obviously the amount is limited. The basic glass structure and inclusion capacity of dangerous waste in fusion are the main factors which should be taken into account, the strength against the water attack is essential. Water is the main degradation vector, irrespective of precautions taken to avoid it. The complexity of the correlation between the chemical structure and basic glass features intended to be vitreous matrix including the waste makes that the structure selection represent a great responsibility.

A carefully controlled crystallization as is the case of vitreous-ceramic matrices may be mentioned that recent studies of including certain dangerous wastes in vitreous-ceramic matrix exist in the literature.

The issue of using the dangerous waste with a metal content was not approached in our country, but ICIM and INS cooperated in order to include different recovered wastes in glass. The most recent example is the contract CEEX:204/20.07.2006-Advanced technologies for a sustainable capitalization through vitreous materials, of borosilicate glass and precipitating sludge containing heavy metals.

The project is intended to develop treatment/neutralization techniques by immobilizing the metals (iron, copper, zinc, lead, chromium, nickel etc) existing in the dangerous waste resulting from ferrous metallurgy and iron working industries, dangerous waste, incineration, wastewater treatment

plants, in vitreous and vitreous – ceramic chemically stable materials, mainly used for façade decorations.

The project also takes into account the ash resulting from the incineration / co-incineration of organic dangerous waste containing dangerous metal compounds; such ash should be treated before storage.

The solutions proposed in this project are the collection and neutralization / capitalization of dangerous waste containing metals, in order to avoid the need for its final disposal by storage.

The project innovation is given by the fact that the technologies for neutralizing / capitalizing the useful compound (iron, copper, zinc, lead, chromium, nickel etc) contained by dangerous waste that will be developed within the project will contribute to both the substantiation of drawing up the Strategy and National Plan for Waste Management by methods and techniques for dangerous waste neutralization/ capitalization and conservation of natural raw materials which will be replaced by recovered metal compounds used as raw materials and /or pigments for mosaics and plating works.

On the other hand the innovation consists in a rational selection of some chemically stable structures allowing to use certain technologies for developing glass and vitreous – ceramics, for polishing the products (considering all implications which could arise due to the waste use).

These technologies are technically optimum and economically efficient and ensure to obtain the expected characteristics so that the products comply with the beneficiaries' requirements and face up the foreign products.

The new technologies will have an innovating character as well related to the issues concerning both the final disposal of dangerous waste with a metal content in order to ensure the environmental protection, and the possibility of providing new additional raw material sources.

The project is considered to comply with the class of complex projects due to the following arguments:

- It promotes the development of highly complex capitalization / neutralization techniques, immobilizing the metals existing in dangerous waste by their including in glass and vitreous – ceramic at the level of European scientific and technical activity;
- It promotes multidisciplinary applicative research (science and engineering of metals, physics, chemistry, environmental protection, management, economy, computing science);
- It relies upon gathering together the contributions of all project partner experts, each partner covering a certain field of activity;
- The technologies subject of this research activity have beneficial effects on the environmental protection, natural raw material conservation, development of improved products;

- It promotes a complex scientific partnership among a national research development institute, an IMM developing research activities, two significant universities and an IMM type SRL. Within this partnership work both well trained experts and young people who graduated high education institutions of Romania.

5. Obiectivele proiectului

The general objective of the project is to develop technologies for neutralizing dangerous waste by its capitalization in vitreous and vitreous-ceramic materials as a result of the cooperation among the consortium partners.

The specific objectives of the project are the following:

- Studies on the metal content dangerous waste neutralization possibilities by the waste capitalization in the field of vitreous and vitreous-ceramic materials;
- Physical-chemical characterization and balance of metal content dangerous waste able to be capitalized in the field of vitreous and vitreous-ceramic materials; Elaboration of models in the laboratory and prediction of the characteristics for vitreous and vitreous-ceramic by using the metal content dangerous waste;
- Elaboration, designing and trial of the laboratory technologies and new solutions proposed to obtain vitreous and vitreous-ceramic materials by using metal content dangerous waste;
- Elaboration of the presentation handbook; Demonstration of the technologies working ability and obtained products utility by using neutralized waste.

The project proposal and all the works that will be developed to carry out technologies for neutralizing the dangerous waste by its capitalization in vitreous and vitreous-ceramic materials comply with the set of moral principles and procedures provided in: Ethics and professional deontology code of research-development staff, Law no. 206/2004, Law 64/1991, Law 129/1992, Law 8/1996 (with subsequent notifications and completions).

The project CD activities comply with the related international regulations and UE specific legislation: Directive 95/46, Ethics and UE funded research (Council Decision 1513/2002/EC on FP 6), EU research on ethics in science (Council Decision 2002/835/EC).

Moreover, the waste amount reducing by the development and use of the technologies for dangerous waste neutralization by means of its capitalization in vitreous and vitreous-ceramic materials complies with the environmental ethics conditions.

All technical documentation (trial reports, studies) will belong to the partners involved in developing the concerned stages. They have the obligation to

disseminate it only having the partners' permission and to mention all the partners.

The scientific and technical original results will be presented in partnership as papers issued in literature magazines or internal and international papers.

If, as a result of the research project, one or more invention patent applications are submitted, the signatory parties will be co-holders. The patent granting rights will be set up by participants depending on the original contribution ratio, according to Law 64/1991.

6. Partners

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7. Project description

Stage	Objective title	Dead line	Estimated S/T outcome
I	O1 Studies on the neutralization possibilities of metal content dangerous waste by its capitalization in the field of vitreous and vitreous – ceramic materials	28.02.2009	Research study; Assessment study on waste quality; Test bulletins; Information-documentation study; Stage report
II	O2 Physical – chemical characterization and balance – sheet of metal content dangerous waste able to be capitalization in the field of vitreous and vitreous – ceramic materials; Elaboration of laboratory models and characteristics prediction for vitreous and vitreous – ceramic materials by using metal content dangerous waste.	30.11.2009	Test bulletins; Hazardous waste balance; Receipts; Laboratory technique; Test report; Performance guidelines; Scientific papers, Published articles; Research report; Stage report
III	O3 Elaboration, designing and trial of laboratory technologies and new solutions proposed to obtain vitreous and vitreous-ceramic materials by using metal content dangerous waste.	30.11.2010	Laboratory technique; Performance guidelines; Sample lot tests; Test bulletins; Experiment report; Scientific papers; Published articles; Research report; Stage report
IV	O4 Presentation handbook drawing up; Demonstration of technologies operational ability and use of the obtained products by neutralized waste use	01.10.2011	Guidelines on the proposed solutions; Demo report; Experiment report; web page; articles; CD's; booklets, stage report; final report