

EUREKA PROJECT E!2609- REC-OXIDE

1. General description

Project	E! 2609- REC-OXIDE	Status	Finished- 21-Feb-2005
Title	Recycling Of Oxides From Industrial Ash Waste For The Steel-Making Industry.		
Class	Project	Technological area	Environment
Start date	01-Jan-2002	End date	01-Jan-2005
Duration	36months	Total cost	0.85Meuro
Partner sought	No		
Summary	Development Of Recycling Technologies For The Production Of Steel-Making Modifiers From Industrial Ash Waste Instead Of Natural Products Such As Caf ₂ , Cac ₂ , Al, Mg And Others.		

Budget and duration

Phase	Budget(Meuro)	Duration (Months)
Definition phase	0.09	8
Implementation phase	0.76	28
Total	0.85	36

Member contribution

Member	Contribution	Position	Since
Czech Republic	43.00%	Notified Finished	21-Feb-2005
Ukraine	34.00%	Notified Finished	21-Feb-2005
Poland	23.00%	Notified Finished	21-Feb-2005

Participants

Company	Country	Type	Role
Impexmetal Dobris S.R.O.	Czech Republic	SME	Main
Inop - Metal Forming Institute	Poland	Research Institute	Partner
East Ukrainian State University/Metal Forming Department	Ukraine	University	Partner
Lutsk State Technical University	Ukraine	University	Partner

2. Project outline

Project description

The target of the proposed project is the development and optimization of technology for processing of slags, scrap, ash and other powder wastes in order to re-use them - in the steel-making industry.

The main advantages of the suggested modifiers are:

a) Today's customers (in the steel manufacturing industry) use traditional modifiers that are: not-effective, heavily polluting and expensive in comparison to the suggested new modifiers. Examples:

- Customers use Calcium Fluoride (environmental hazard) to reduce the viscosity of steel slag.
- Applying magnesium powder and Calcium Carbide for sulphur removal.
- Applying Ferrous alloys of various types for de-oxidization.
- Using conventional ferrous scrap for steel manufacturing.

b) The suggested new modifier will improve the customer manufacturing process (being more efficient, effective and economic) and eliminate environmental problems.

The developed new modifiers will be:

1. Ferrous Oxide - Carbon briquettes with exothermal additives, which substitute ferrous scrap and reduce energy consumption during the steel making process. Ferrous oxide - carbon briquettes are cheaper in comparison with conventional scrap.
2. Steel slag formers - non-ferrous metal granules and oxide mixtures made from industrial wastes. They are applied to protect, refine and to de-oxidize molten steel at the end of the processing steps. The new composition of mixtures ensures high effectiveness and consequently less consumption in comparison to the existing modifier (mixture 'Scorialit SPH'). Our product is prepared from dust wastes and granules and costs less than other conventional mixtures.
3. Aluminium waste briquettes for reducing steel slag viscosity substitute calcium fluoride in the steel making process. They are at least 50% cheaper than calcium fluoride; however the quality of steel is at the same high level.

Summary:

The advantages of the suggested steel manufacturing modifiers are as follows:

1. High effective modifiers with new compositions, by applying magnesium oxides.
 2. Low price of our modifiers in comparison to conventional products such as fluoride, calcium carbide and others.
 3. Replacement of usual ferrous scrap by low price, oxide-carbon briquettes with exothermic additives.
 4. Ecologically-friendly modifiers without fluoride content.
- For production of these products the special powder technology is offered and will be developed.

The main feature of PM technology offered is the development of the new flexible shear warm compaction technology. The main operations of this technology are mixing and heating of the mixture due to exothermic reactions effect, shear warm compaction of the mixture with definite composition, drying and packing of products. The

new shear warm compaction technique ensures obtaining high density and high strength of briquettes that consist of reactive ingredients.

This flexible technology is applied:

1. To compact ferrous oxide-carbon briquettes with exothermic additives.
2. To compact briquettes from reactive aluminium slag dust wastes.
3. To compact high density metal pallets (bars, wires and others) from scrap and powders.

The shear forming (compaction) technology will be combined with granulation operation in order to obtain non-ferrous metal granules in a single production cycle of preparing of steel slag formers of various types.

Keywords: recycling, metallurgy, slag.

Technological development envisaged

The technological objectives are:

1. Development of a new, warm compaction technique for processing of solid ash industrial wastes.
2. Development of combined compaction-granulation technology for the production of steel-making modifiers such as slag formers, exothermic mixtures and others.
3. Development of the new re-using prospects for products made from waste.

The offered new shear warm compaction technology allows to put into processing non-metallic, ash-type industrial waste materials (oxides, salts, carbides and others) due to intensifying of inter-particle interactions during their shear flow. The exothermic reactions between waste ingredients results in increase of temperature that is used to rise bonding between particles at the consolidation process. These are the main features that make new technology differ from conventional briquette production. Expected output: new products made from solid industrial wastes instead of natural materials: ferrous oxide-carbon briquettes, steel slag formers, Al. Slag briquettes. These ones are aimed at steel making processes as modifiers instead of natural materials.

Markets application and exploitation

The customers for the new modifiers:

The main customers for our new modifiers are traditional Steel manufacture Industries (both small and large) and many other foundry plants. The modifiers are used in steel manufacturing process for purposes such as; Sulphur removal, de-oxidation, diminishing of slag viscosity, etc.

The consumption of modifiers for an average steel industry is between several thousand tons to 100 thousand tons of modifiers per year. The demand for high effective and low cost modifiers for the Steel Industry in thousand of tons of each modifier per year.

In the international market of the steel-making industry, large volumes of ferrous and non-ferrous scrap, natural products such as CaC_2 , CaF_2 , Al_2O_3 and synthesized ceramic materials are handled. The developed products are planned to be applied at steel-making plants in the CZECH REPUBLIC, POLAND and The UKRAINE in increased volumes each year.

For the first year after start of manufacturing:

CZECH REPUBLIC - 200-500 tons;

UKRIANE - 500-1000 tons;

POLAND - 200-500 tons.

For the second year:

CZECH REPUBLIC - 500-1000 tons;

UKRAINE - 1000-2000 tons;

POLAND - 500-1000 tons.

The results of this project will be exploited by putting production plants for manufacturing steel-making modifiers from wastes into operation in the CZECH REPUBLIC, ISRAEL and the UKRAINE.

Project codes

BSI

P	production engineering
U	metallurgy

NACE

29	Manufacture of machinery and equipment not elsewhere classified
45	Construction

3. Main participant

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Organisation type SME
Participant role Main

Contribution to project

Co-ordinator, development of equipment for processing Al. Slag wastes, implementation of warm compaction technology and equipment for manufacturing Al slag briquettes. Marketing analysis of application prospects of Al slag.

Expertise

Company was established on 4.02.99. General range of activity: - producing products for foundry industry and metallurgy, - processing metallic and non-metallic metallurgical wastes and scrap, - purchase of goods for re-sale. Currently, the company has a branch in the UKRAINE and co-operates with Slovakian and Russian companies.

4. Partner

Company **Inop - Metal Forming Institute**
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Organisation type Research Institute
Participant role Partner

Contribution to project

Study and development of shear compaction techniques for consolidation of non-metallic powder wastes. Designing, execution and implementation of devices and tools for technology realization.

Expertise

The Metal Forming Institute (INOP) was founded in 1948 and has 7 divisions and 5 departments. The objective and scope of INOP's activity are: conduction of scientific and research work in the field of applied theory of metal plasticity and collaboration with industry (development of technologies for products made by metal forming methods). Moreover, experts of INOP improve existing and develop new methods of manufacturing household products, machine parts, devices and tools by metal forming powder metallurgy, in order to reduce material and energy consumption and improve the quality of products. INOP also performs education in metal forming and improves the scientific and professional qualifications of INOP's own employees and those of industry, develops and propagates scientific, technical and economic information, develops metal forming and powder metallurgy development directions. The Institute has obtained the Certificate of the Quality Management System according to Standard ISO 9001:1994 approved by LLOYDS REGISTER Quality Assurance and Accreditation Certificate no L 105/2/1999 of THE POLISH CENTRE FOR TESTING AND CERTIFICATION in the field of structure and metal properties research. In 1999, INOP executed two grants from PHARE SCI-TECH II. In addition, INOP is currently carrying out three EUREKA projects: * 'E! 2123 A new generation of forging tools', * 'E! 1983 High-strength materials for cold volume forming - assortment of wires and rods', and * 'E! 1806: Powder metallurgy high-accuracy rotary die-forming technology and equipment' and has obtained favourable decision on the funding of the project INT-PULS-FORM in the Fifth Framework Programme of the EUROPEAN COMMISSION.

4. Partner

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Organisation type University
Participant role Partner

Contribution to project

Development of the new combined technological processes for processing of oxide wastes of various

Contribution to project

Development of initial cleaning-drying operations and experiment for processing of ferrous oxide-oil mixtures (rolling scale, grinding waste and others).

Expertise

One of the youngest higher educational establishments of the UKRAINE. Its history dates back as far as 1996 when the General Engineering Department of KIEV MOTOR-CAR AND HIGHWAY ENGINEERING INSTITUTE was founded. In 1997, on the basis of the decision of the STATE ACCREDITATION BOARD of THE UKRAINIAN MINISTRY OF EDUCATION, Lutsk Industrial Institute has got the highest - the fourth grade of accreditation, the status of University and the name of LUTSK STATE TECHNICAL UNIVERSITY. This is the modern educational, scientific-engineering and cultural centre both of Volyn and the western region of UKRAINE. The University today comprises 7 educational and laboratory buildings, a library having 3 branches, 2 hostels, a sports complex, sports and health camps. Educational and scientific work is carried out in 25 departments and 8 divisions, where the engineering - technical personnel is trained in 17 professions. A total of 2700 day time and 1700 part time students study here. Educational work of the University is based of the possibilities of board choice of syllabi and subject courses by students. The programmes functioning in the University are: - Bachelor (in all 17 specialities); - Specialist and Master in 9 specialities; - Post-graduate training; - Preparatory and Advanced professional Training. Scientific Research is conducted by the budget financing as well as on a self-supporting basis. During the last years it has been concentrating on solving technical problems and topical problems of economic reform. For years, the scientists of the University have been carrying out the fundamental investigations in physics, mathematics, mechanics and chemistry. Recently new specialities have been initiated, such as, Agricultural Machine-Building, Science of Materials, Powder Metallurgy, Composite Materials, Semiconductors, Power Supply, Economics. The specialised Boards conferring Candidate degrees in engineering according to scientific specialities are: 1. Science of Materials. 2. Mechanical Engineering. 3. Mechanization of Agricultural Production. 4. Agricultural Machinery. Professor Victor Volodymyrovych Bozhydarnyk has led the University educational establishment since 1977.