



SCIENCE & TECHNOLOGY PARK ZEMUN – BELGRADE, SERBIA

*WITH
RESEARCH & DEVELOPMENT
CENTER
AND MEMBERS
SMALL & MEDIUM ENTERPRISES*

**INCUBATOR OF TECHNOLOGIES AND
NEW BUSINESSES**



SCIENCE & TECHNOLOGY PARK ZEMUN

**THE FIRST SERBIAN TECHNOLOGY PARK REGISTERED AT THE
MINISTRY OF SCIENCE AND TECHNOLOGICAL DEVELOPMENT
(SINCE 2006)**

The Science & Technology Park of IHIS with its member firms engages in developing innovation technologies and small scale production of innovation products. The Park renders services to entrepreneurs in forming start-up firms and starting their business. On its own or with its research and development center (IHIS Techno Experts Ltd.) and IHIS Development and Production Center Ltd. IHIS S&T Park participates in calls for proposals issued by the Ministry of Education and Science for development and innovation projects.

INNOVATION TECHNOLOGY fields:

- Applied electrochemistry and chemical power sources
- Inorganic and organic materials
- Welding and consumables
- Corrosion protection of metals
- Production of ceramic tiles for bulletproof vests
- Biotechnology
- Raw materials and additives for the pharmaceutical, food and other industries
- Small energy sources important for preserving the environment
- Purification of natural and waste water
- Making of Business Plans and Feasibility Studies
- Design and complete engineering

Production and storage zones

- 5500 m².

Office space in the administration building

- 650 m².

IHIS S&T Park key members:

- IHIS Research & Development Center (IHIS Techno Experts Ltd.)
- IHIS Nutrition Ltd.
- IHIS Materials Ltd.
- IHIS Elektrottraction Ltd.
- Galfos Ltd.

IHIS S & T Park offers:

- Production, storage and office space
- Bookkeeping
- Legal and Translation services
- Engineering and consulting services





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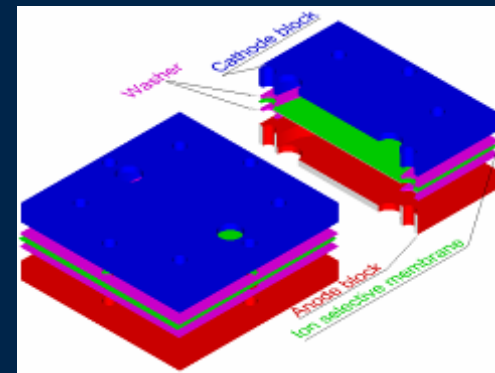
Research & Development Center

FLOWTHROUGH ELECTROLYZER FOR PRODUCTION OF FERRATE(VI)

Ferrates are the salts of Fe (VI) which have excellent oxidation, coagulation, and disinfection properties, and the range of the applications in environment friendly chemistry. Ferrate (VI) as an alternative reagent for treatment of water can be used instead of chlorine compounds. Ferrates(VI) solution can be easily synthesised by the anodic transpassive dissolution of iron and its alloys in concentrated alkaline solutions.



FLOWTHROUGH ELECTROLYZER
PILOT-PLANT



FLOWTHROUGH
ELECTROCHEMICAL CELL



RECLAMATION OF
WASTEWATER
FROM COAL
SEPARATION
PLANT
BY FERRATE(VI)



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Research & Development Center

DEVELOPMENT OF A DEVICE FOR CALIBRATION OF STEEL STRIPS AND MANUFACTURING CORED WIRE FOR THE :

- MAG - MIG WELDING PROCESS ($\varnothing 1.2 - 1.6 \text{ mm}$)&**
- SAW - SURFACING WITH BROAD COATING USING POWDER ($\varnothing 2,0 - 3,2 \text{ mm}$)**



**Cored wire for the
MAG-MIG**



Cored wire for the SAW



**Macro photograph cross
section**



**MAG-MIG
welding
process**



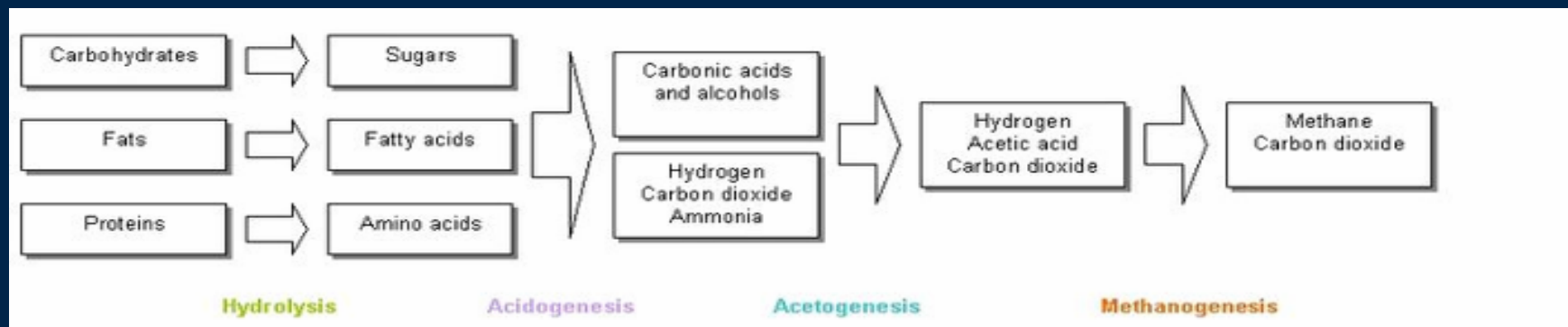
**SAW
welding
process**



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SMALL SCALE BIOGAS DIGESTER FOR HOUSHOLDS

ANAEROBIC DIGESTION



Average temperature	15°C
Hydraulic retention time (HRT)	100 days
Working reactor volume	10 m ³
Digester type	Plug-flow digester
Dilution	2:1
Input material	67 kg pig manure/day + 26 kg plant biomass
Biogas production per kg of pig manure	≈ 60 liters
Estimated daily biogas production	4 – 5 m ³
Measure daily biogas production	1,5 – 2 m ³
Average methane content in biogas	60%
Bioreactor Feeding Rate	1 – 2 daily

BIOREACTOR WORKING PARAMETERS



BIOGAS DIGESTER INSTALATION



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The IHIS ST Park has experiences in reconstruction plant for bioethanol production from molasses, as well as an old "warm" technology of corn pretreatment of bioethanol plant from corn. Thin stillage and distillers grains (whole stillage) are byproducts remaining after bioethanol production. Thin stillage can be feed alone or in combination with distillers grain or better utilize is when whole stillage enriched by probiotic yeast. Thin stillage is also appropriate material for lactic acid production.



Dried whole stillage



Dried *Saccharomyces cerevisiae*

Innovative projects

1. Improving of quality of whole stillage after bioethanol production as animal feed
2. New products obtained lactic acid fermentation of thin stillage



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NUTRITION



IHIS Nutrition is a science institution oriented towards the food technology businesses. It offers outstanding technical support working with a number of relevant partners at home and abroad. With pride, in addition to its own experts, it brings together the highest quality professionals in the field of technology, biotechnology, nutrition, food quality and food safety. □IHIS-Nutrition does research in the field of nutrition, food and nutrients that our bodies need for optimal performance.

IHIS-Nutrition has experts to advise on the manner of labeling food products, dietary supplements, products with special dietary needs, etc.

- We propose health and nutritional statements for food products.
- We do trials of your products in order to obtain the required health notices
- We implement legal norms concerning the quality of the product as well as the accompanying documentation
- We implement European standards of quality.
- We give expert opinions about products with specific health notices
- We harmonize your product labeling requests with the legislation of Serbia and EU.
- We propose improvement of existing products with raw materials with a positive effect on human health in order to produce functional products and methods of their identification and separation from similar products in the market.
- Post-marketing supervision of products.



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PRODUCTION POSSIBILITIES OF CERAMIC TILES FOR BULLETPROOF VESTS

The use of structural ceramics for ballistic protection is a relatively new application. First high quality ceramic armor was developed in the United States during the late nineties, for bulletproof vests and seat-armor in helicopters. Ceramic armor is mainly used for personnel and vehicular ballistic protection by military forces and police teams, for protection of some critical parts of aircraft and helicopters, and for blast protection against landmines.

Today, carbide discs are the most modern approach to solving the problem of protection from the guns and other small arms fire. The mechanisms of ballistic protection of ceramic and kevlar armor are significantly different. Kevlar absorbs the projectile kinetic energy by a plastic deformation mechanism. Ceramics absorb the projectile kinetic energy by a fracture energy mechanism.

Usually, the ceramic armor system consists of a monolithic ceramic or composite ceramic-metal body covered by ballistic nylon and bonded with a high-tensile-strength fiber lining.

Also some soft metals (e.g., aluminum thin sheets) can be used as a backing material for vehicular protection.

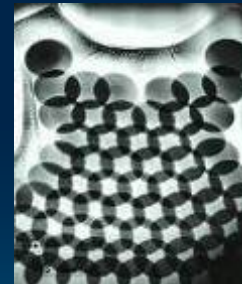
Upon impact of the bullet (velocity of more than 700–800 m/sec), the hard-facing ceramic body is cracked and broken, and the residual energy is absorbed by the soft reinforced backing material. This backing material also must support postimpact fracturing of the ceramic body caused by the bullet and the bullet itself.

As the material for the manufacture of ceramic armor used is silicon carbide, boron carbide, aluminum oxide or systems $\text{Al}_2\text{O}_3\text{-SiO}_2\text{-CaO-MgO}$ and $\text{Al}_2\text{O}_3\text{-MgO}$ with an Al_2O_3 content of min. 97.5 wt%.

Ceramic bulletproof vests are usually produced by placing the ceramic discs, in a vacuum coating and by arranging them like fish scales, see the Picture. The discs are slightly lens like, circular, 50mm in diameter and 5mm thick.



(a) External appearance



(b) X-ray photography

Position of the ceramic disks in bullet-proof vest

The results obtained by the our experiments satisfy the standard value of ceramic tiles made from silicon carbide, boron carbide and aluminum oxide, which are used for bulletproof vests according to the U.S. Department of Justice – National Institute of Justice adopted the NIJ Standard–0101.06, for the classification types: Level 3 to Level 5.

IHS Scientific & Technology Park – Zemun plans to realize the production of carbide discs for bulletproof vests in cooperation with prof. dr Vladimir Krstić, from Queen's University, Kingston, Canada.



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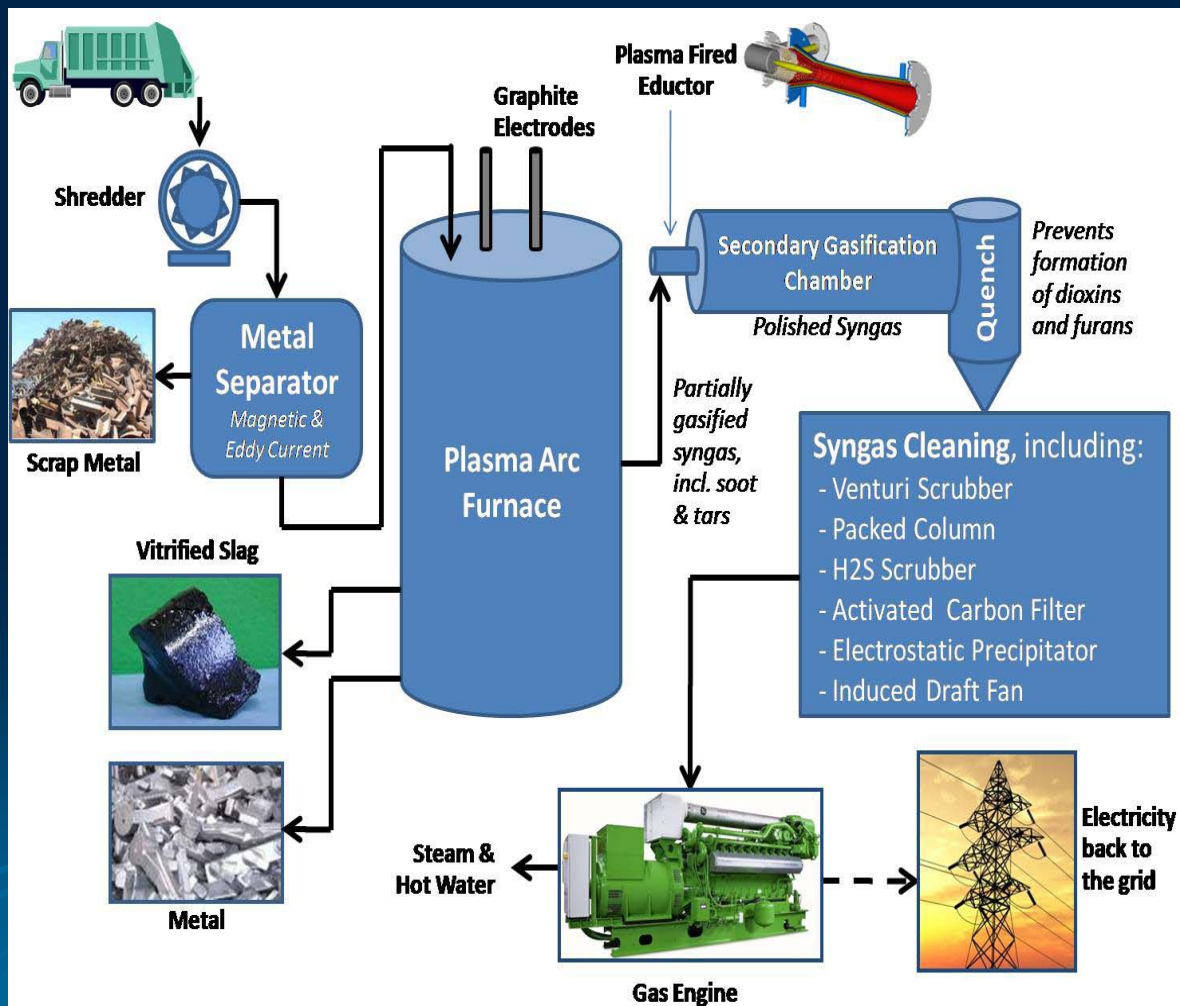
CITIES WITHOUT GARBAGE – INDUSTRY WITHOUT WASTE (Application of “PLASMA RESOURCE RECOVERY SYSTEM”)

In the world today (USA, Canada, Japan, Russia) there are already several companies developing industrial waste treatment processes using plasma technology. Many of these systems are already at the level of daily treating 20, 50 or even 100 tons of waste. All these systems are inherently better than the European approach of burning or high-temperature burning - incineration, which is used in Europe for hazardous waste also.

Unlike incineration plasma processes are also cheaper in the investment (up to 15%), they take up much less space, and most important they are virtually 100% environmentally friendly. Treatment of waste in addition to energy, electricity and heat, produces a glassy slag (used for various purposes as construction material) and alloys of metals present, which are subsequently refined. Emissions meet the European and U.S. standards and do not pollute the atmosphere.

IHIS S&T Park up to now activities:

- Reversible TEEP through plasma coal gasification;
- Serbian TEEP ecologically friendly through partial coal plasma gasification

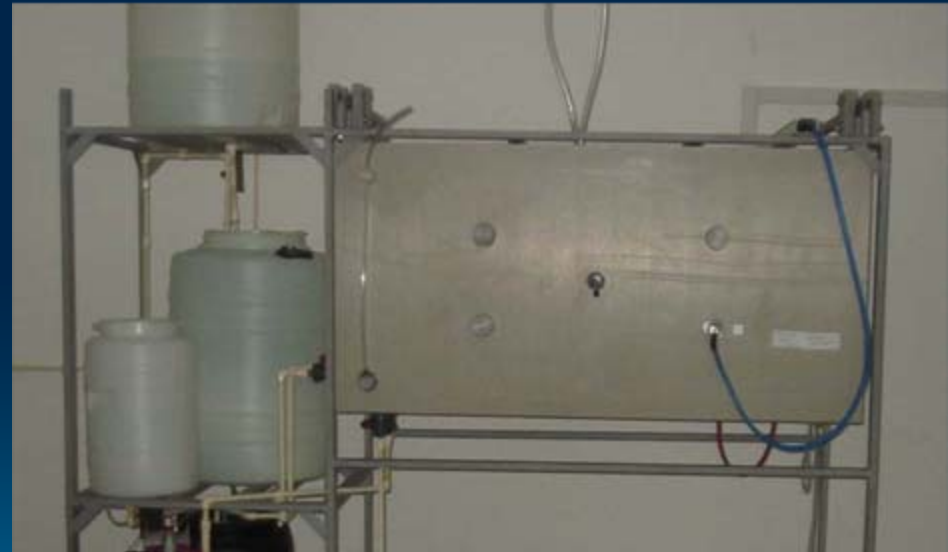




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Searching for an effective desinfectant agent, in our Institute we developed an ecology-friendly solution on the basis of silver and hydrogen peroxide. This agent is an ecology-friendly water solution, which is extremely effective in destroying many microbiological cultures such as *Salmonella choleraesuis*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Bacillus Cereus*, *Staphylococcus*, *Enterococ. faecalis*, *Candida albicans* and many others. Extraordinary microbiological effects of our agent have been tested and proven effective at the Military Medical Academy in Belgrade, Laboratory for Testing of Disinfectants. This agent is exceptionally effective and it is completely biodegradable breaking down into water and oxygen. Since it does not contain chlorine, aldehydes nor phenol it is quite acceptable to be applied in the food industry, industry of water and industry of all other agents that are directly related to people. Besides, the effects are far stronger and longer lasting, even at elevated temperatures, than those of other agents available on our market. Our disinfecting agent is even more times effective than H_2O_2 . Apart from the above mentioned bacteria and fungi it also destroys viruses and protozoa. Except from it being an extremely effective disinfectant as described above, the composition of the agent described in this work is completely non-toxic to humans, animals and plants.

Mastering of various biotechnologies, and investing in production of ecological disinfectant and other products on the basis of electrochemically activated water



**Pilot laboratory for testing and production of
ecological disinfectant**



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REFERENCE LIST OF R & D AND RECENTLY IMPLEMENTED PROJECTS

ADVANCED MATERIALS AND ELECTROCHEMISTRY

- Modified alloys of Pb-Ag-Ca for electrode grids in lead-acid batteries and anodes in hydrometallurgy (2008)
- Mastering of technological procedure of production of new quality high alloyed wear resistant chrome-molibden steel with addition of vanadium (2008)
- Production technology of hard and soft solders (1995)
- New product introduced in production: the universal agglomerated flux for submerged arc surfacing (2008-2009)
- Research, development and introduction of an experimental plant for optimal steel strip calibration, composition of flux cored wire filling and technological procedure of production of flux cored welding wire (2005-2007)
- Exploring the possibility of replacing tungsten carbide with boron carbide for making tools in mechanical engineering (2006-2007)
- Investigation of optimal structure of metal components and hydrophobic low-molecular compounds for development of a new metallurgical quality of flux cored wire for welding of steel intended for low-temperature operation (2008-2010)
- Development of an electrochemical process for production of ferrates (FeO_4^{2-} , FeO_4^{3-}), strong environmentally friendly oxidant agents (2008-2010)
- Development of production technologies for coatings and cores based on local raw materials for manufacture of special coated electrodes intended for arc welding of steel (2011 –*
- Development of environmentally friendly methods for treatment of harmful substances using ferrate(VI) and electrochemical oxidation or reduction (2011 –*

BIOTECHNOLOGY AND MEDICINE

- The development, implementation and commercialization of sensors for non-invasive measuring of arterial blood flow (2008)
- Methods for improving stillage quality as animal feed after production of bioethanol (2008)
- New products obtained by lactic acid fermentation of stillage (2010)

ENVIRONMENT PROTECTION

- Development of new technology of municipal water treatment applied to small plants for households and industry (2008)
- Improvement of storage, treatment and use of liquid and solid waste collected from agricultural farms and/or related branches of industry with obtaining and use of energy essentially biogas (2010)
- Managing of waste fluorescent tubes which contain mercury - for the city of Belgrade (2010)
- Study of environmental protection and sustainable development of the municipality of Bor - aspect of the corporation for copper mining, refining and smelting (2008)
- Waste management of used nickel cadmium batteries and solving the issue of their recycling - for public transportation service of Belgrade (2008)
- Specialist course (workshop) for unemployed engineers on plasma technologies for commercial use - for the city of Belgrade (2010)



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**IHS Science & Technology Park Zemun became a
member of Balkan Environmental Association
(B.EN.A)
in July 2006.**

