



EYE ON THE FUTURE



**CENTRAL METALLURGICAL RESEARCH AND
DEVELOPMENT INSTITUTE [CMRDI]**

CMRDI History

- In the early 1970's CMRDI was just a metallurgical department in the National Research Center.**
- In early 1980's with the help of UNIDO the different laboratories, pilot plants and administration was established and CMRDI moved to its current premises near to the industrial region of Helwan.**
- CMRDI depended on its well developed international cooperation to get modern pilot plant machinery and equipment which helped in the achievement of more than 300 industrial development projects on contractual basis in the last decade.**

Vision

**CMRDI is a World
Class Center**

Mission

**Contribute to the National Economy
Through Sustainable Development of
Egyptian Industry**

Objectives

**Product & Process Development Replacing Imports
by Local Materials Human Resources
Development**

Future Outlook

**Fostering International Cooperation Centers of
Excellence Infrastructure
Upgrading Financially
Sustained Institution**

Board

President

Vice President

**Minerals
Technology**

**Metals
Technology**

**Advanced
Materials**

**Manufacturing
Technology**

**Technical
Services**

**Minerals
Characterization**

Steel Technology

**Composite
Materials**

**Casting
Technology**

Chemical Testing

**Minerals
Beneficiation &
Agglomeration**

**Non-ferrous
Metallurgy**

**Electronic and
Magnetic
Materials**

**Joining
Techniques and
NDT**

Physical Testing

**Chemical and
Electro-
metallurgy**

**Plastic
Deformation**

**Ceramic and
Refractory
Materials**

**Powder
Metallurgy**

**Mechanical
Testing**

**Pyro
Metallurgical
Processing**

**Corrosion Control
& Surface
Protection**

Nano Materials

**CAD and Rapid
Prototyping and
Manufacturing**

**Techno-
Economic
Studies**

CMRDI Personnel

• Research staff:	
■ Emiritus Professor	21
■ Professor	20
■ Assistant Professor	21
■ Researcher	48
■ Senior Research Assistant	17
■ Research Assistant	29
Sub-Total	156*
• Engineers and Chemists	42
• Technicians	92
• Technical Labours	46
• Assistants, admin. & Labours	203
Total Personnel	539

* More than 20% of research staff are females

Main Activities

- 1. Introduction of new technologies , product development and process development.**
- 2. Imports substitutions and export support.**
- 3. Utilization for indigenous raw materials.**
- 4. Industrial wastes treatment and recycling.**
- 5. Technical and technological support for SME's and materials characterizations services.**
- 6. Failure analysis and trouble shooting.**
- 7. Training and qualification.**

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1. LASER TECHNOLOGY



- ☐ 2.2 KW Solid State Laser
- ☐ 6 Axes Robot.

Industrial Laser Applications

- ❑ Introduction of the Laser technology to Egyptian SME's.
- ❑ Production of high quality products.
- ❑ Materials: Low carbon steel, Al- alloys, Austenitic and duplex stainless steels, etc.



2. Surface Engineering Technology.

- ☐ Electro-Deposition
- ☐ Vapor-Deposition
- ☐ Diffusion Coating
- ☐ Surface hardening by phase transformation
- ☐ Thermal spraying
- ☐ Hardening and cladding
- ☐ Laser treatment



3. Precision Casting Technology

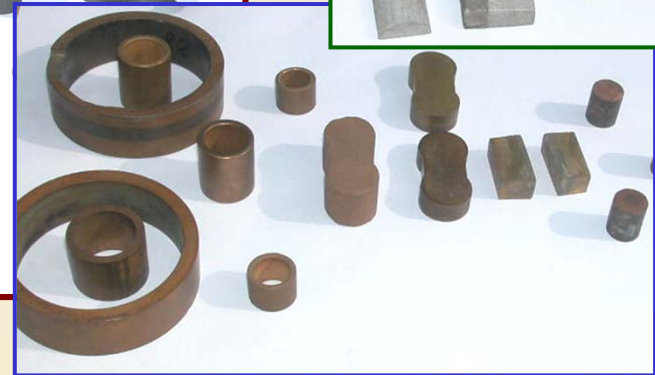
- ☐ Shell molding .
- ☐ Cold box for cores production .
- ☐ High pressure die casting .
- ☐ Lost wax investment .



4. Powder Metallurgy Technology



- ☐ Production of special tooth and cutting edges
- ☐ Production of high speed cutting tools
- ☐ Hard and soft magnets
- ☐ Composite materials





5. Heat Treatment Technology

- ❑ Gas carburizing and carbonitriding
- ❑ Austempered ductile iron (ADI)



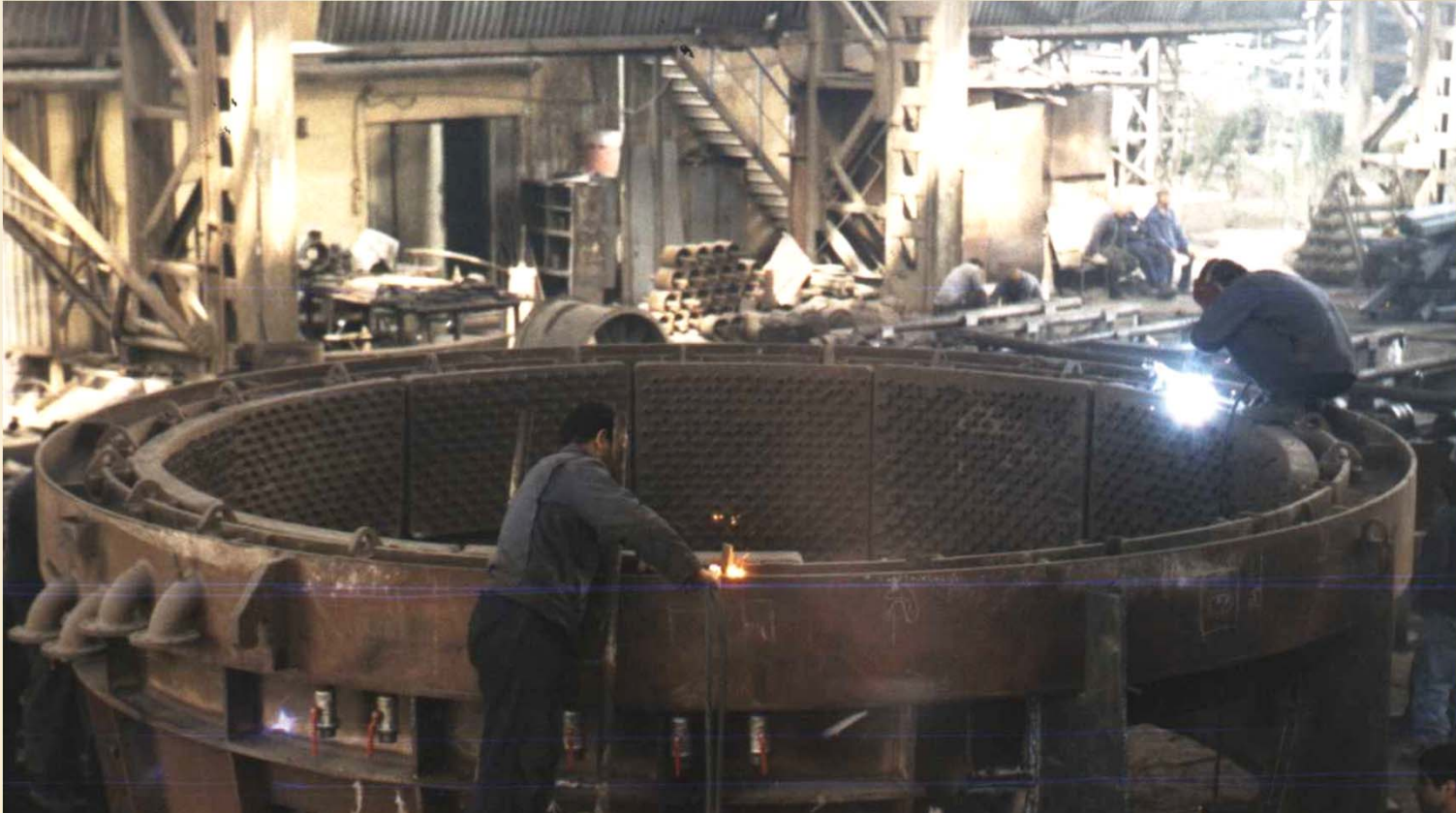
6. Bi-Metallic Casting

Production of special machine parts

- ☐ Wear and abrasion resistant materials
- ☐ Hammers for cement crushing
- ☐ Wheat mills
- ☐ Introduction of ductile iron to the Egyptian foundries
- ☐ Such technology is already transferred to Egyptian companies for producing rolls and rolling mills



7- Industrial R&D Projects



Water cooling panels for walls and roofs of electric arc furnaces, replacing refractories in steel mills

Technology transferred with MEFOS - Sweden. Under WAITRO umbrella

Application of Oxygen Lancing Technology in EAF

Characteristics :

- * Needs low capital investment.
- * The process must be optimized for the furnaces with different capacities and different working conditions .

Economic Impact :

- * Decrease of melting duration.
(20 - 40 %)
- * Decrease of heat duration.
(15 - 30 %)
- * Decrease of electric power consumption.
(15 - 40 %)

Applied in :

- * Egyptian Iron and Steel Co. One 6-ton EAF
Two 12-ton EAF
- * Egyptian Copper Works . One 25-ton EAF
- * Delta Steel Mill Co. Two 25-ton EAF
- * National Metal Industries Co. Two 35-ton EAF

Application of Slag Foaming Technology in EAF

Characteristics:

- Graphite powder injection between
- slag layer and metal surface.
- Low capital investment
- Applied in furnaces with different capacities.



Economic Impact :

- Energy saving (10-40 kwh/ton steel)
- Decreased electrode consumption (~10 %)
- Net time saving (~ 8)
- Improvement of steel quality
- Higher yield of ferroalloys
- Decrease of noise pollution



Applied in Egyptian Iron & Steel Co.

Bolts and Nuts , Free Cutting and Spring Steels

Produced in :

- Delta Steel Mill Co.

Characteristics :

- Have the same properties as imported .
- No capital investment .

Economic Impact :

- More profitable than normal grades
- Saving hard currency .



Free Cutting Steel



Bolts & Nuts



Spring Steel

Production of New Grade of Steel Shots for Casts Cleaning

Technology :

- * Melting of high C- steel microalloyed with Ti
- * Dispersing molten steel stream by water jet under high pressure
- * Spherodisation and solidification of produced particles in water bath
- * Drying and screening to different sizes
- One- step tempering process

Characteristics :

- * High C- steel microalloyed with Ti
- * Density : $> 7.4 \text{ gm / cm}^3$
- * Hardness : 41 - 51 HRC
- * Microstructure : Tempered martensite
- * Grain size : $< 1.8 \text{ mm}$ 40.5 - 52.5 %
 $> 1.8 \text{ mm}$ 47.5 - 59.5 %



Produced in : CMRDI pilot plant

Production of High Strength Microalloyed Steels

Bars for Reinforcing Concrete

Characteristics

- * Microalloyed with V or Ti ($\leq 0.1 \%$)
- * YS : min 400 Mpa UTS : min 600 Mpa
- * High ductility El : $\geq 18 \%$
- * Weldable
- * No special processes are needed.

Economic impact

- * Indirect increase of productivity.
- * Saving 30 % of steel in concrete.
- * More profitable for producer & end user.

Produced in

*Delta Steel Mill Co. *National Metal Industries Co.

Production of High Strength Microalloyed Steels

Wire for Prestressed Concrete

Characteristics:

- * High carbon steels microalloyed with V
- * High tensile strength : 1550 - 1600 Mpa
- * Diameter : 7 - 11 mm
- * Clean technology (no polluted patenting)
- * No capital investment for companies having cold drawing

Economic Impact:

- * More profitable than normal steel grades
- * Saving hard currency



Produced in:

- * Delta Steel Mill Co.
- * National Metal Industries Co.

Production of Ferroalloys from Local Ores



C%	Mn%	Si%
1.1	75	15



Ti%	Al%	Si%
25-30	8-10	2-4



Cr%	C%	Si%
52	7	3-5



Mg%	Ca%	Si%	Ce%
5.0	1.0	50	0.4



Ti%	Al%	Si%
40	2-5	1-2



Cr%	C%	Si%
62	0.02	2.8-4.4

Energy Saving in High Carbon Ferromanganese Alloy Production



High Carbon Ferromanganese Plant- Sinai Manganese Company, Abu Zenima



The Production Process of HC-FeMn at SMC, Abu Zenima

Energy Saving = 15%

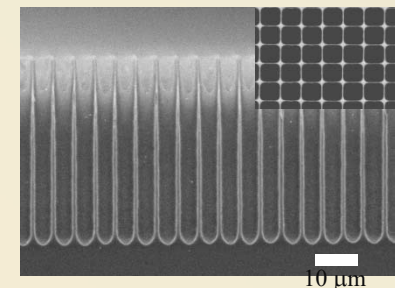
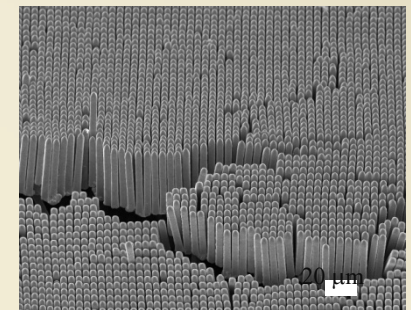
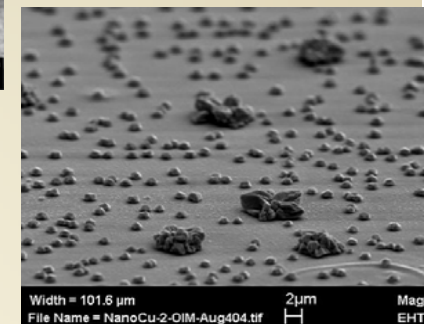
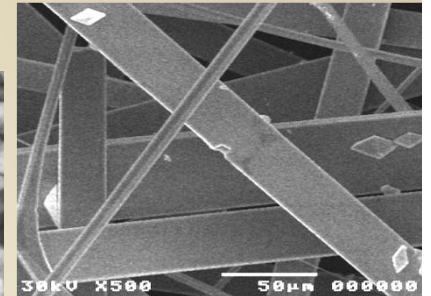
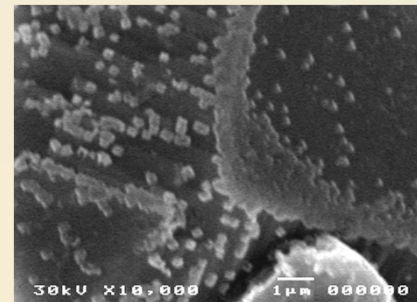
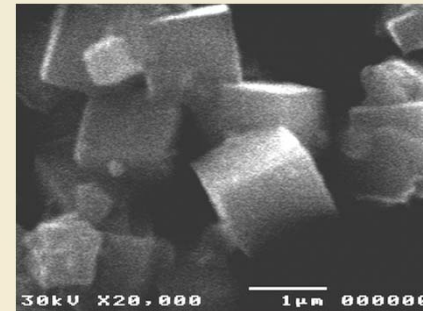
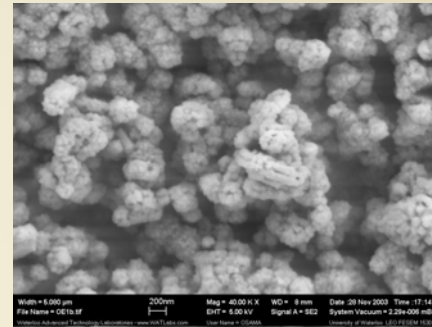
8. Production of New Materials (Nano-Structured Materials)

Examples:

- Nanoparticles (Crystals, amorphous, wires, fibers, ...).
- Nanometals, Oxides, Carbides and Nitrides,
- Thin films.
- Nano tubes.

Applications:

- ❑ Electronic cells, composites, condensers, porous glass and advanced ceramics and pharmaceutical industries.



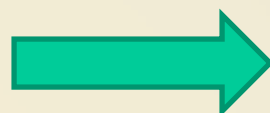
TECHNIQUES USED BY CMRDI GROUP FOR SYNTHESIS OF NANOMATERIALS

- **Sol-gel.**
- **Hydrothermal and Solvothermal.**
- **Microemulsion.**
- **Co-precipitation.**
- **Chemical and Physical Vapor Deposition (CVD) & (PVD).**
- **Electrodeposition.**
- **Mechanochemical.**
- **Solid-Solid & Gas-Solid.**

IV. Nanotechnology in Catalysis



Photocatalysts



**Powder, Thin Film,
Magnetic catalyst**

Degraded Materials



Cyanide, Heavy metals, Dyes,....

Under UV and Visible light

I. Nanotechnology in Catalysis



- Removal of Sulfur from Petroleum Oil;
using **Zeolite Mordenite (Co-P.I.)**



STDF Running Project

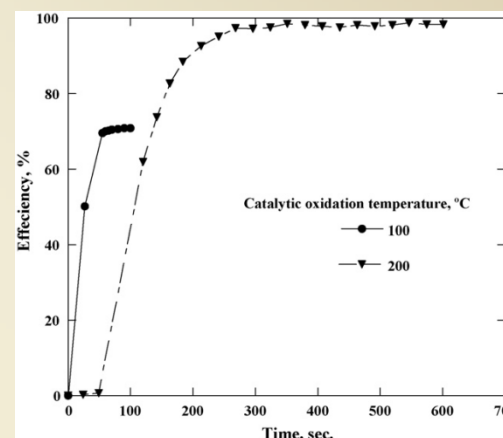
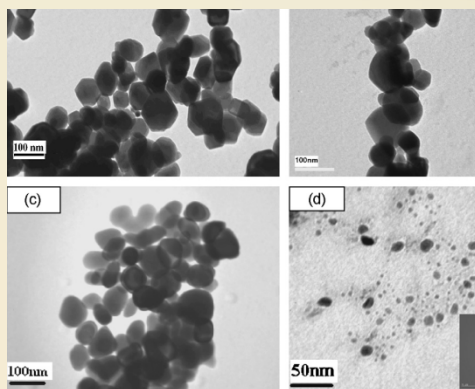
I. Nanotechnology in Catalysis



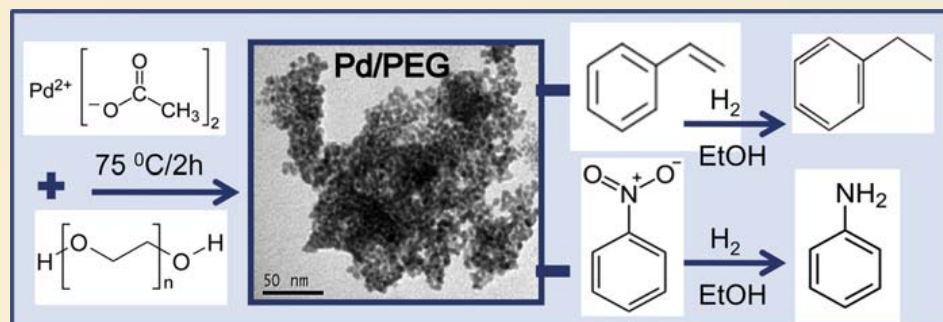
➤ Oxidation of Co with Nano-scale metal oxide; **Fe₂O₃**

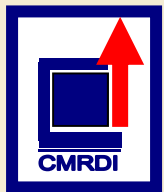
➤ Maghamite phase

➤ high surface area (244m²/g)



➤ Nanoparticles for organic transformation; **PdNPs**





Central Metallurgical R&D Institute
P.O. Box : 87 Helwan, Cairo, Egypt



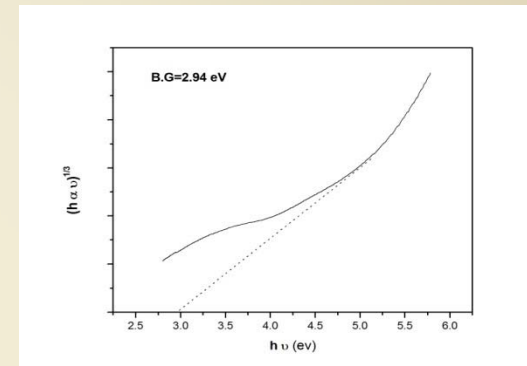
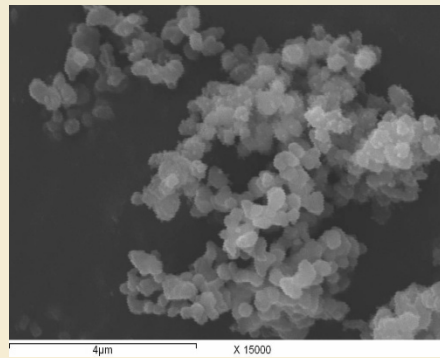
Nanotechnology for Magnetic Applications

- ❖ Nanocrystalline barium and strontium hexaferrite for microwave absorbance and magnetic application (2009-2012)
STDF funded project 150,000US\$ (member)
- ❖ Bioactive nanocrystalline magnetic materials for hyperthermia treatment of Cancer (2009-2012)
STDF funded project 160,000 US\$
- ❖ A novel approach for fabrication technology of mullite nanoparticles from industrial wastes for advanced applications
(2012-2014).
US-Egypt joint project 160,000 US\$ (University of Folrida)

Other Studies

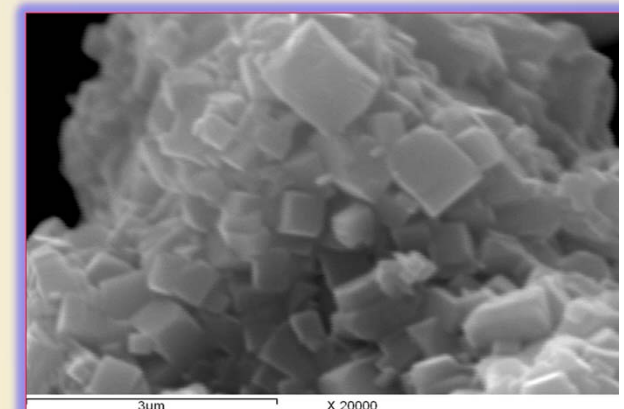


1- Synthesis of strontium titanate from Egyptian celestite ore for Electrooptics devices

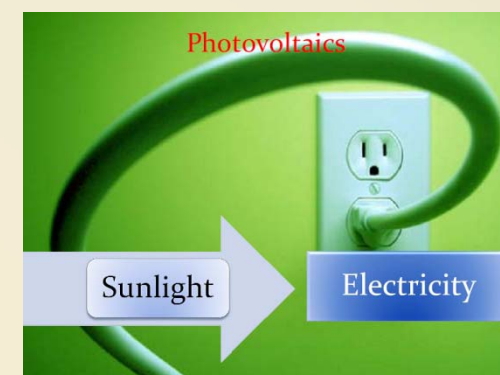
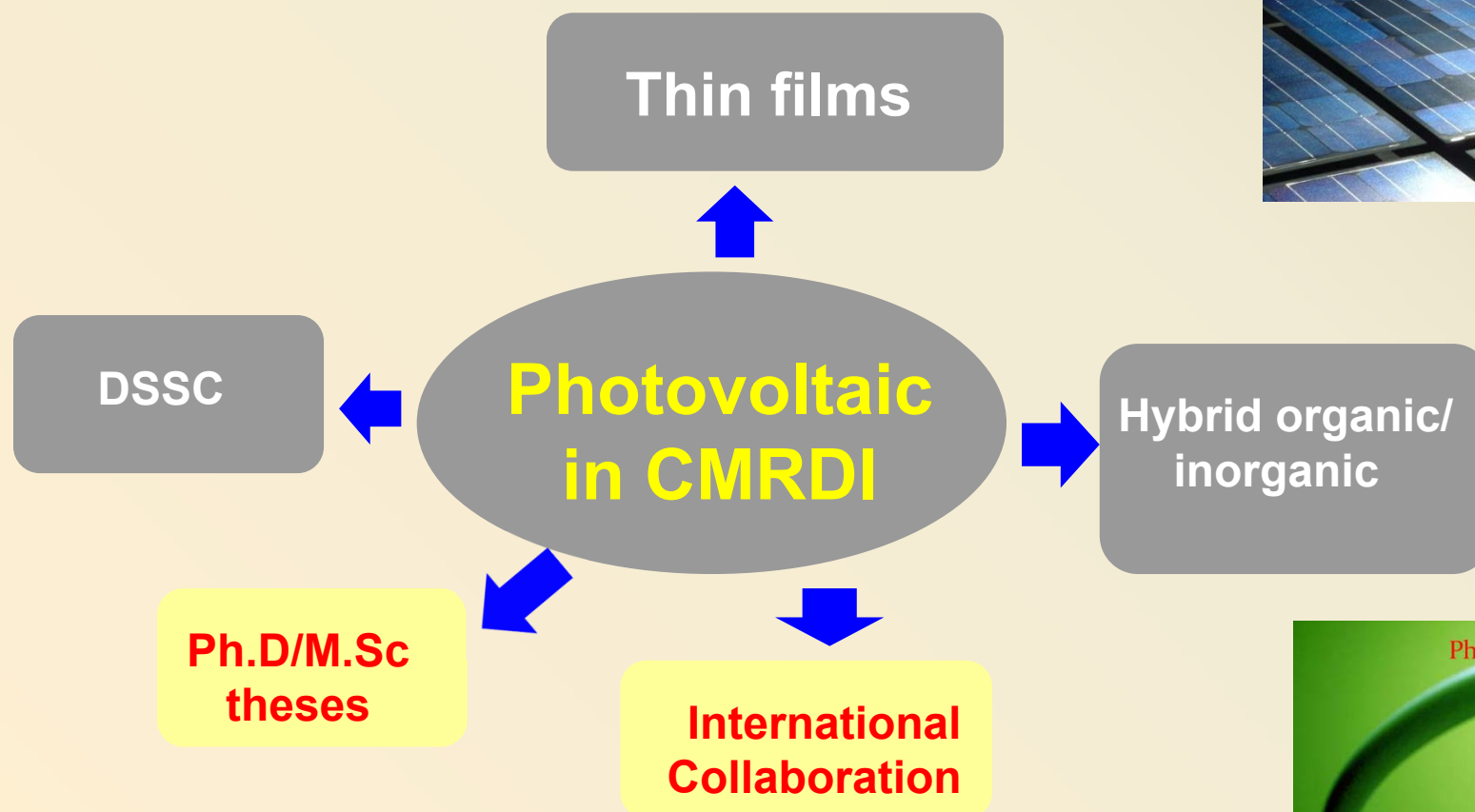


- 2- Synthesis of lead titanate using hydrothermal method
- 3- Synthesis of barium strontium titanate for electronic applications

No	Organic acid type	Molar ratio	$\rho : (\Omega\text{m})$	R: <u>Ohm</u> , Ω	c.size
1	Oxalic acid	1	1.034826×10^{10}	10.8081×10^{13}	33.1
2	Malic	1	1.5006×10^{10}	15.6729×10^{13}	36.4
3	Tartaric	1	0.91165×10^{10}	9.52167×10^{13}	56.3



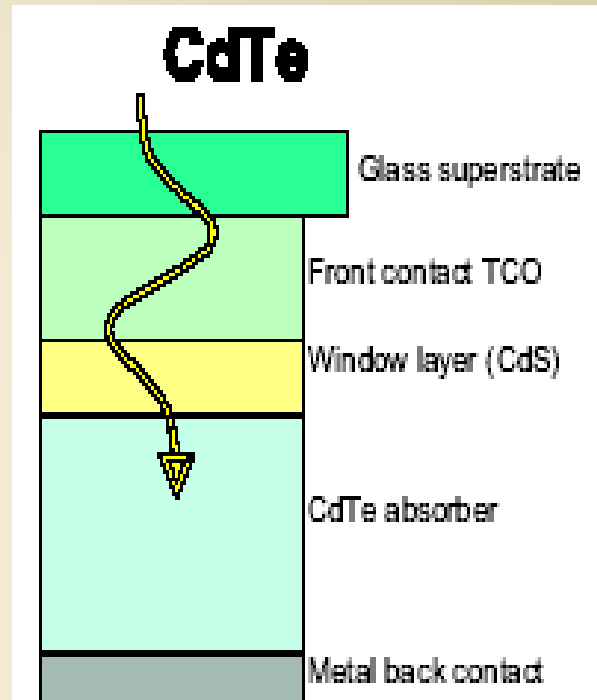
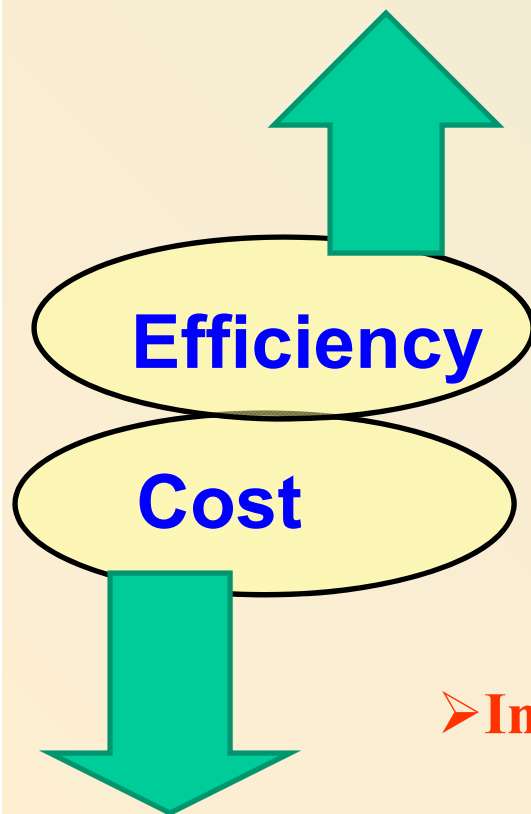
Nanotechnology in Energy



Thin Film Photovoltaic (PV)



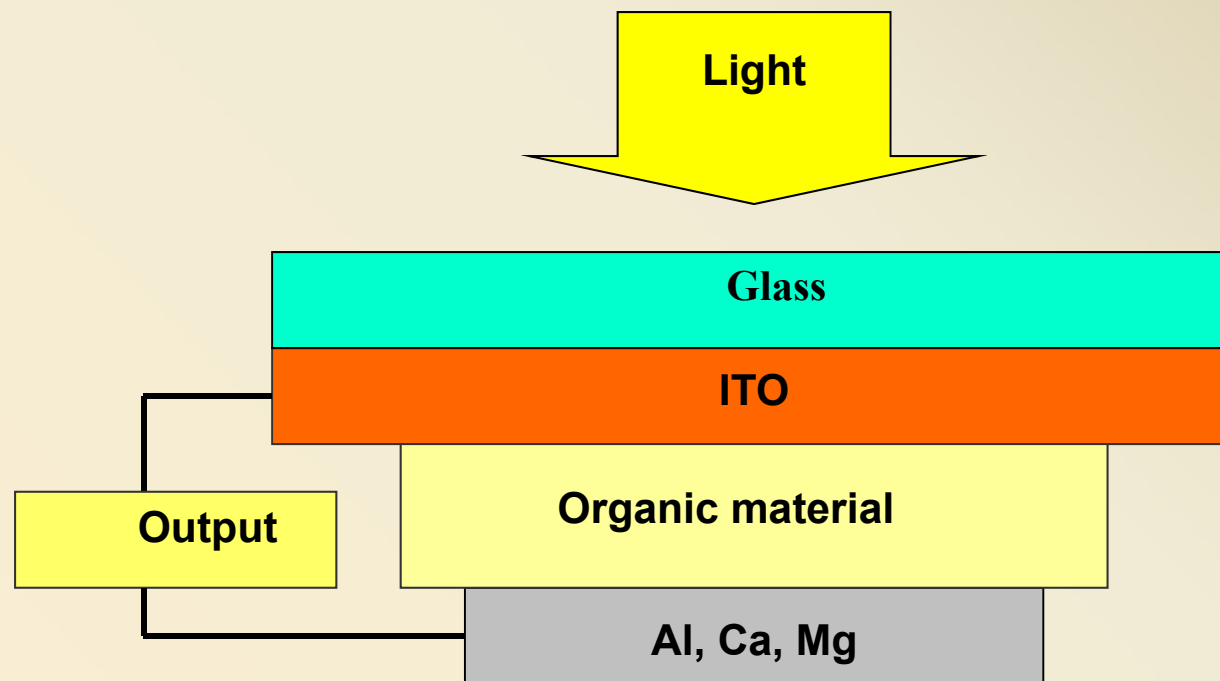
...use cheap semiconductor thin films deposited on low-cost substrates



➤ In CMRDI: CdSe, CdTe, ZnSe, ZnTe, ZnO

US-Egypt Running Joint Project

Polymer-based PV



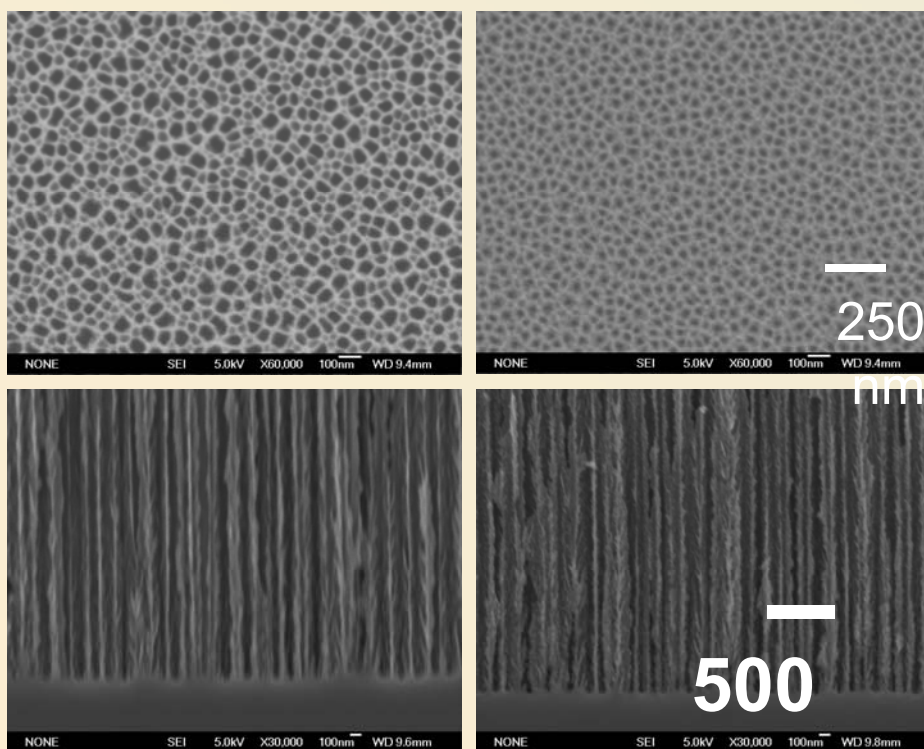
tune polymer band-gap ✓
low cost, ✓
simple process ✓

low efficiency ?
long-term stability ?
poor contact ?

Hybrid organic/inorganic PV



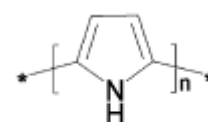
Porous Silicon



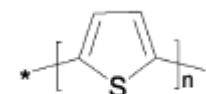
nm

F. A. Harraz, S.M. El-Sheikh et al, *Electrochim Acta* (2008), 50 (27), p. 6444

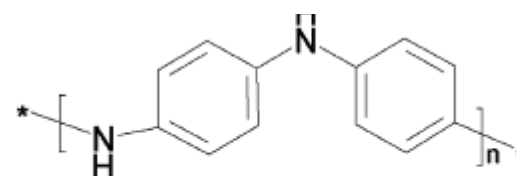
STDF Running Project (9000 US\$)



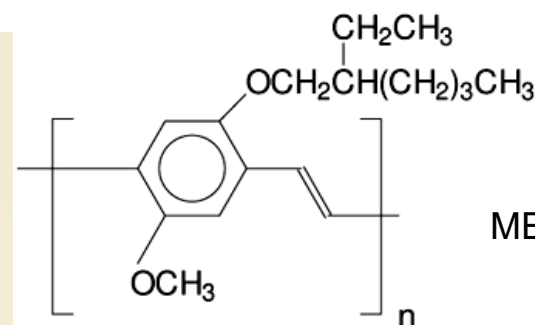
Polypyrrole



Polythiophene



Polyaniline



MEH-PPV

Poly(3-Hexyl Thiophene) P3HT

Existing Equipments



- XRD
- XRD with Heating Stage
- XRD Thin Film
- XRF
- SEM
- HR-TEM
- Surface Area Analyzer
- TG - DTA – DSC
- ICP
- FTIR
- Micro-RAMAN
- PL
- Vibrating Sample Magnetometer; VSM
- Impact Testing Machine
- Plane Bending Machine
- Optical Emission Spectrometer
- Potentiostat-Galvanostat/FRA
- Spin Coating
- High vacuum chamber system
- Centrifuge
- Dynamic light scattering particle size analyzer

Existing Equipments



- Densimeter
- GC
- AUTOSORB -1-MP Surface Area Instrument
- BELCAT-B Temperature Programmed Desorption
- Thermal Conductivity Tester
- Tube Furnaces, Temp.1500 C°
- UV-Vis Spectrophotometer
- Impedance
- Electrical Resistivity
- Melting Crucible Furnace (Capacity 3 liter, Temp.1300 C°)
- Computerized Furnace for Heat Treatment (Temp.1000 C°)
- Wear Test Machine
- Hardness Tester Machine

MATERIALS HAVE BEEN PREPARED

- ☐ TiO_2
- ☐ ZnO
- ☐ $\text{TiO}_2\text{-SiO}_2$
- ☐ $\text{V}_2\text{O}_5\text{-SiO}_2$
- ☐ $\text{V}_2\text{O}_5\text{-TiO}_2\text{-SiO}_2$
- ☐ $\text{ZnO-TiO}_2\text{-SiO}_2$
- ☐ ZSM-5 zeolite
- ☐ Zeolite A
- ☐ TiSi_2 thin film
- ☐ Ferrite (Ba, Ni, Cu, Zn)
- ☐ Metal/CP/Au/Si & PS
- ☐ TiN, AlN
- ☐ C_3N_4 thin film
- ☐ ZnO/SnO_2 nanorods
- ☐ Cu nanocubes

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1. Manufacturing High Quality Spare Parts

- ❑ Advanced foundry unit
- ❑ Advanced unit for welding technology
- ❑ Complete line for heat treatment
- ❑ Integrated laboratories for measuring the chemical and physical properties of materials as well as QA of products



The pilot plant at CMRDI can be used as a small production unit





2. New Foundry Unit for Advanced Melting Technology

- ❑ Advanced melting technology unit with a capacity up to 2 tons /day for producing special alloys for chemicals, petrochemicals, and strategic industries.
- ❑ Most of these special alloys are imported.



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Impact of Producing Value -Added Products

Mineral/ Ore	Exporting without Upgrading ~ \$/ton	Cost of Upgrading ~ \$/ton	Int. Price \$/ton* (Dec. 2008)
Washed Sand (Glass)	8 – 12	8	40
Floated Sand (Crystal)	8 – 12	10	80 - 90
Value-added Sand (Optical)	8 – 12	15	135
Na Feldspar (Porcelain & Glass)	15 – 25	15	60 – 205
K Feldspar (Ceramic)	10 - 15	20	85 – 125
Kaolin (Ceramic, Sanitary- ware)	15	40	75 – 125
Kaolin (Porcelain, paper)	15	60	125 - 185
Talc (Filler)	15 – 25	45	185 - 205

1. Maximizing the Economics of Maghara Coal

- ❑ Decreasing sulfur content from 3.0% to 1.0% using the conventional technology
- ❑ Extraction of 20-25% resins (Price = 1500-2000 \$ / ton)

2. Production of Bleaching Powders from Local Bentonite Ores

- ❑ Efficiency of the products is ~ 80% as compared to the imported ones



3. Maximizing the Benefits of Ilmenite Ores

Producing pure titanium dioxide from local ilmenite ores

CMRDI suggests the following studies :

- ☐ Production of pure titanium dioxide, titanium sponge and titanium alloys from local ilmenite resources
- ☐ Production of pure zirconium oxide and zirconium alloys from local zircon resources
- ☐ Separation of rare earth minerals from monazite for producing super alloys



Main Activities

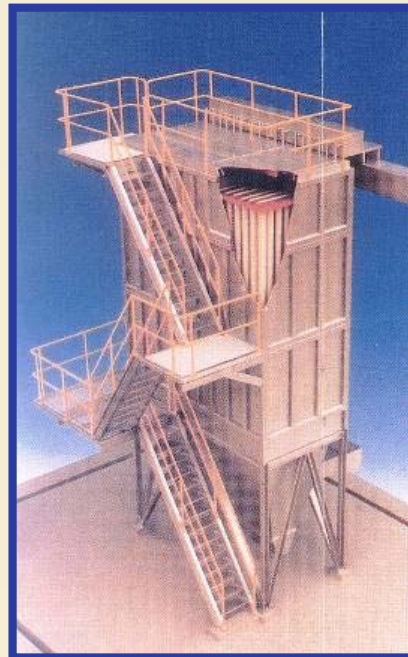
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1. Clean Foundry Technology

- ❑ Ministry of Industry has a plan for reallocation of small foundries to a new area based on sound scientific, technological and environmental system
- ❑ CMRDI is interested in playing a role in such important national plan



Design and Manufacture of
Dust Collection Units for
Foundry Furnaces through a
Joint Program with MEFOS
(Sweden)



Bag Filter



Multi Cyclones Unit

2. Treatment of Chemical Wastes

- ❑ Treatment of process water using new materials
- ❑ Recovery of lead metal from old electrolytic batteries
- ❑ Recovery of zinc metal from metallurgical wastes
- ❑ Recovery of precious metals from industrial wastes
- ❑ Recovery of caustic soda from industrial wastes



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Material Evaluation and Technical Services

■ Material Evaluation and Testing

- Chemical Analysis:
XRF, XRD, Emission Spectrometers, Gases in Metals, DTA, TGA.
- Physical Analysis:
Atomic Dilatometer, Surface Area Analyzer, High Speed Density Analyzer, Thermal Diffusivity, Differential Scanning Calorimetry, Magnetic Properties Evaluation.
- Mechanical Testing:
Universal Testing Machines up to 1000KN, Impact, Hardness and Microhardness, Rotating Bending, Plane and Uniaxial Fatigue Testing, Creep Evaluation, Tribometry.
- Metallographic Analysis:
Optical, SEM, TEM

1. Mechanical, physical and chemical testing facilities.



- ❑ **The Technical Services Unit at CMRDI plays a very important role in supporting SME's.**
- ❑ **This unit helps in developing local products and increasing their competitive capabilities.**





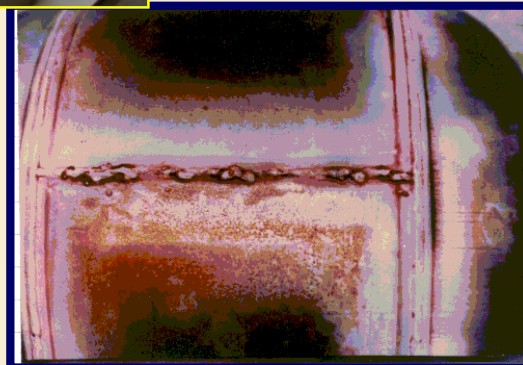


Accredited Tests

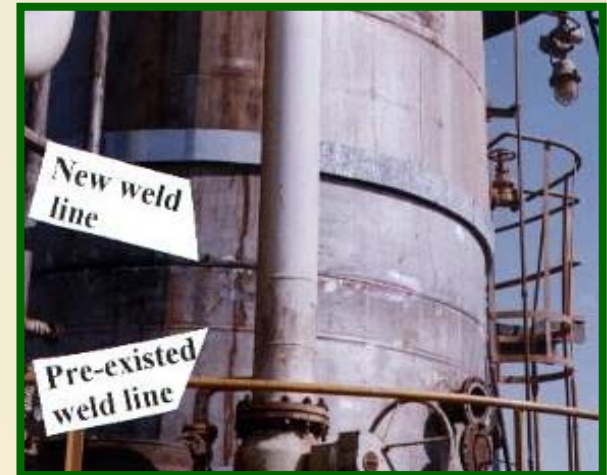
- Chemical Testing:
 - 1- Chemical Analysis by Optical Emission (ARL & Spectro).
- Physical Analysis:
 - 2- Phase Identification by XRD.
 - 3- Coating Thickness Measurement.
 - 4- Surface Area Analysis.
 - 5- Imaging by SEM and Analysis by EDS.
- Mechanical Testing:
 - 6- Tensile Test.
 - 7- Brinell Hardness.
 - 8- Vickers Hardness.
 - 9- Rockwell Hardness.
 - 10- Micro Hardness.
 - 11- Impact Test

2. QC/QA services

CMRDI helps many companies for implementing QA/QC systems



Quality System for Replacement of Blow Nozzles of DC Reactor of Egyptian Petrochemicals Co.



Preventive Maintenance of a Scrubber at PVC Plant of Egyptian Petrochemicals Co.



Adjusting diameter of new section



Replacing top section



Checking fitting of new section



After assembling top section

Emergency Maintenance of a Reactor at the Egyptian Petrochemicals Co.



Reactor after failure



Damaged tube bundle



Replacing inlets and outlets of tube bundle



Repair welding outside of shell

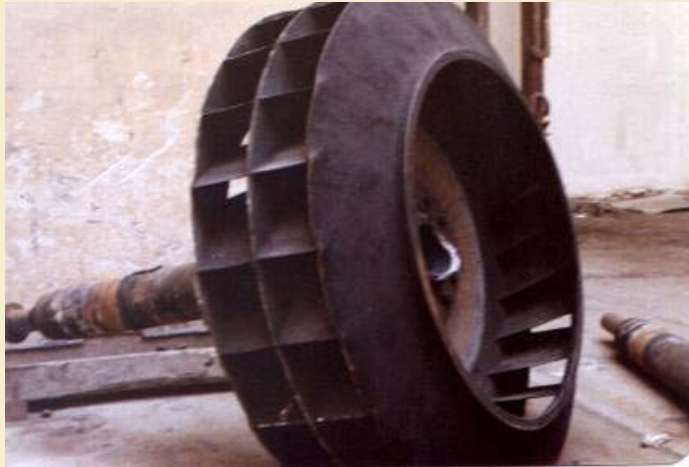
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- 6. Failure analysis and trouble shooting.**
- 7. Training and qualification**

Repair Welding of Secondary Reformer at Abu-Qir Fertilizer Co.



Failure Analysis Case Studies



**Suction Fans of Boiler Flue Gases
at South Cairo Power Station**

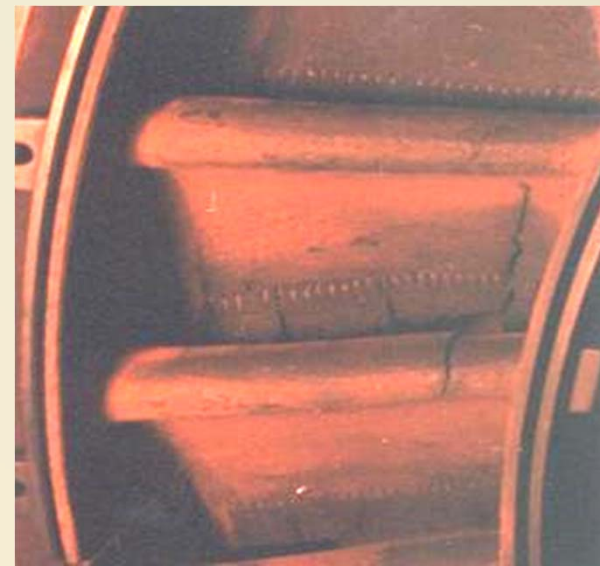


Gas Duct at GUPCO Power Station

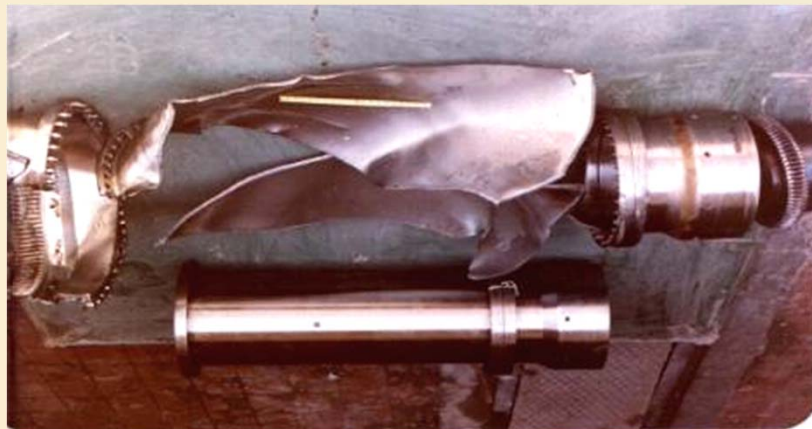
Failure Analysis Case Studies



Line SUMED Pipe



Turbine Nozzles at SCPS



**Coupling Sleeve at Abo-Qir
Fertilizer Co.**

Failure Analysis Case Studies

- **Failure Analysis of Main Landing Gear of Boing Aircraft.**
- **Failure Analysis of Wheel Drum of Air-Bus A320 (Two Cases)**
 - *Right Main Landing Gear.*
 - *Nose Landing Gear.*
- **Failure Analysis of Shock Absorber of Main Landing Gear of Air-Bus A320.**
- **Failure Analysis of Electric Transmission Cables Models ASCR, AAAC, AAC.**
- **Failure Analysis of Assiut Power Generation Water Wall Tube Boiler.**
- **Failure Analysis and Repair Welding of Secondary Reformer at Abu-Qir, Talkha and Delta Fertilizer Companies.**

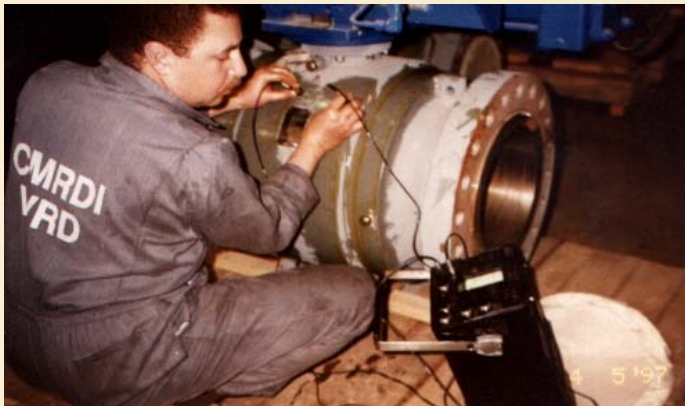
Non-Destructive Inspection



Radiographic Test



Magnetic Particle Test

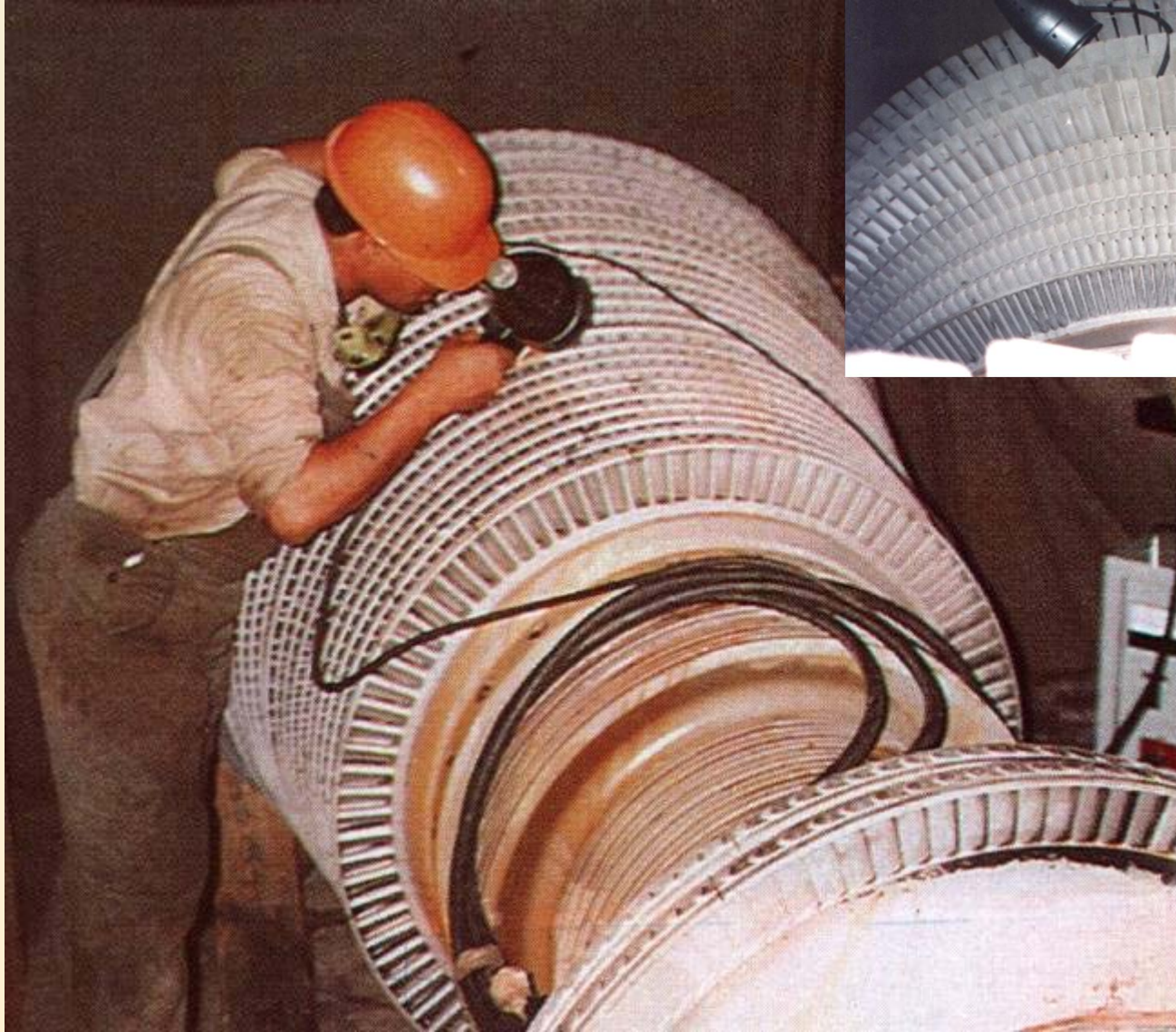


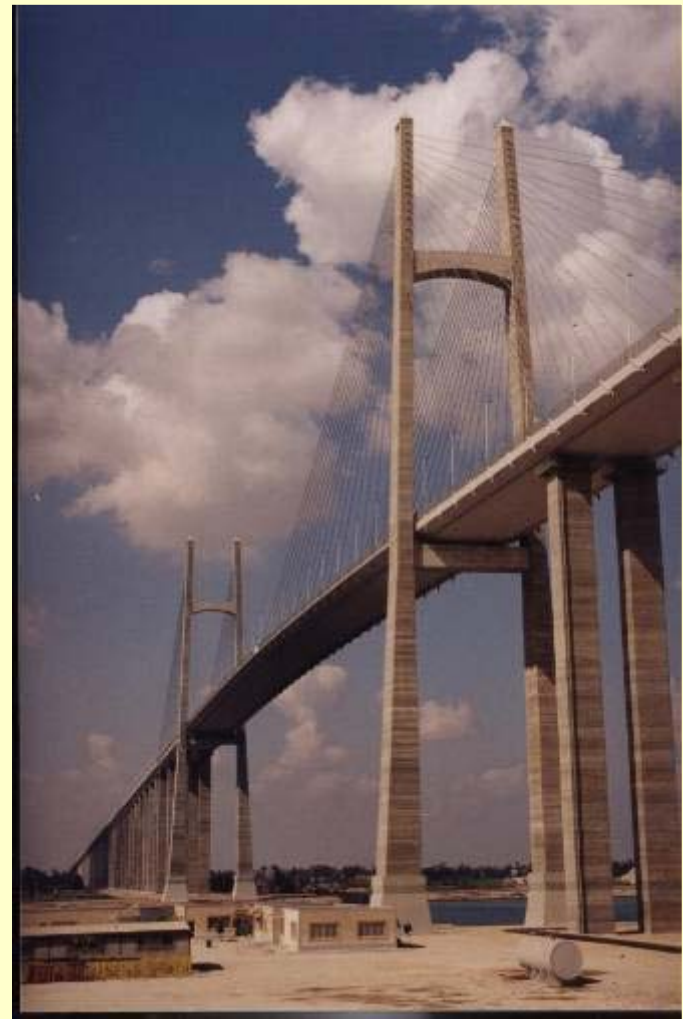
Ultrasonic Test



Dye Penetrant Test

Power Plants





**Suez Canal
Bridge**

Main Activities

- 1. Introduction of new technologies or product development or process development**
- 2. Imports substitutions**
- 3. Utilization of indigenous raw materials**
- 4. Industrial wastes recycling**
- 5. Technical consultancy for QA/QC systems and failure analysis**
- 6. Training and Qualification**

جانب من السفراء الأفارقة بالقاهرة أثناء الندوة



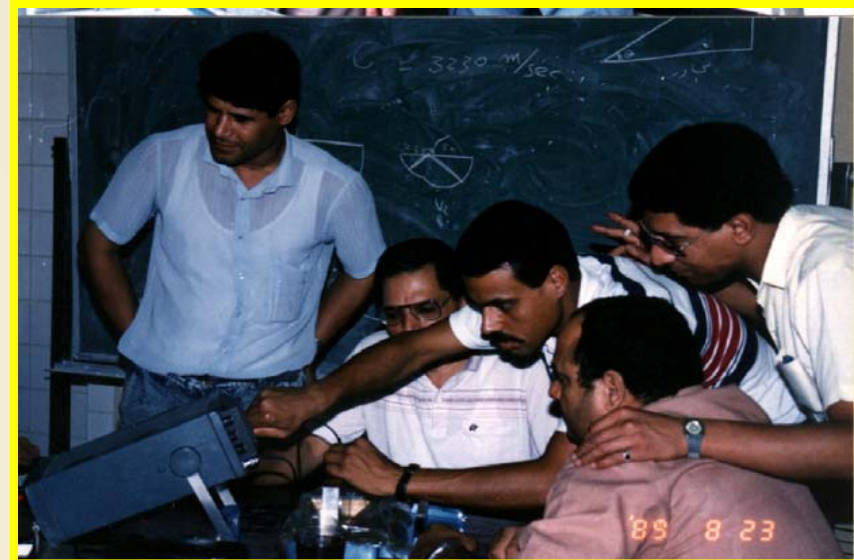
- دعم التعاون فى مجال أستغلال الثروه المعدنيه
- تدريب الكوادر الأفريقيه
- أعداد دراسات الجدوى المبدئيه للمشروعات



TRAINING AND QUALIFICATION FOR WELDERS



TRAINING AND QUALIFICATION FOR NDT PERSONNEL



TRAINING COURSE FOR THE INTERNATIONAL WELDING INSTITUTE

IIW GUIDELINES FOR TRAINING OF WELDING ENGINEERS AND WELDING TECHNOLOGISTS

Theoretical Education	Teaching Hours	
	IWE	IWT
Welding processes and equipment	102	80
Materials and their behaviour during welding	110	80
Construction and design	64	40
Fabrication, applications engineering	110	80
<i>Subtotal</i>	<i>386</i>	<i>280</i>
Fundamental practical skills	60	60
<i>Total</i>	<i>446</i>	<i>340</i>



International System for the Education, Examination
and Qualification of Welding Personnel

INTERNATIONAL INSTITUTE OF WELDING

Having met the requirements of the current issue of
Document IAB-001-2000/EFW-416



CENTRAL METALLURGICAL RESEARCH
AND DEVELOPMENT INSTITUTE

is hereby awarded the certificate of

IIW Approved Training Body
under the authority of the Authorised National Body

Schweißtechnische Zentralanstalt

in the Country of

Egypt

for training courses as shown in the corresponding Schedule

Certificate No.: EG 001

Date of Issue: May 17, 2005

Date of Expiry: May 17, 2008

Dr. Klaus Wichard
ANB Chief Executive



This certificate is the property of the issuing
ANB and may be withdrawn or recalled



International System for the Education, Examination
and Qualification of Welding Personnel

INTERNATIONAL INSTITUTE OF WELDING

SCHEDULE CORRESPONDING TO
ATB CERTIFICATE No. EG 001



The Approved Training Body

under the authority of the Authorised National Body

Schweißtechnische Zentralanstalt

in the Country of

Egypt

is allowed to award the following IIW Qualifications:

Guideline	Date of Authorisation
International Welding Engineer	17. May 2005
International Welding Technologist	17. May 2005
International Welding Specialist	17. May 2005
International Welding Practitioner	17. May 2005

17. May 2005
Date of Issue



Dr. Klaus Wichard
ANB Chief Executive



This certificate is the property of the issuing
ANB and may be withdrawn or recalled



2. Training on Industrial Laser

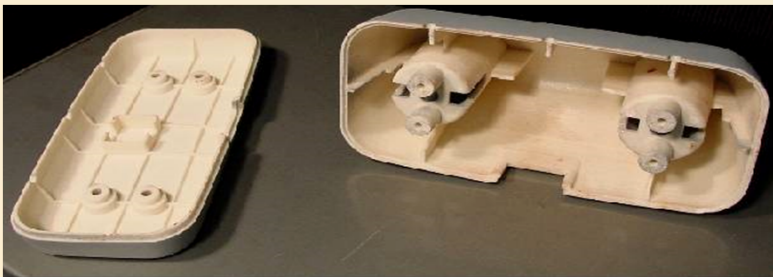


3. Training on CAD/CAM

- ☐ Computer Aided Drafting and Modeling.
- ☐ Mechanical and thermal stress analysis (Finite Element Analysis)
- ☐ E-engineering and Rapid Prototyping Manufacturing.
- ☐ Advanced Manufacturing Techniques



Die Design and Manufacturing Engineers



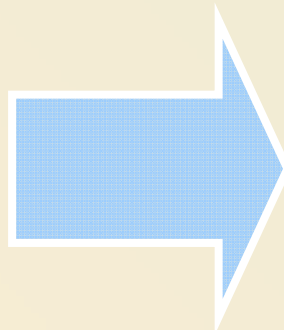
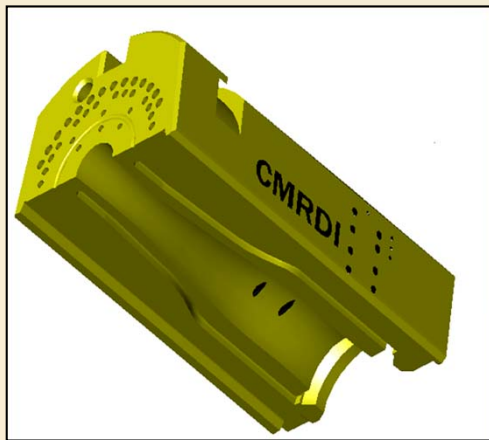
E-manufacturing and Rapid Prototyping Manufacturing

CMRDI is working to establish an excellence center for using the advanced e-manufacturing and Rapid prototyping manufacturing techniques for industrial development, and especially for Die design and manufacturing.

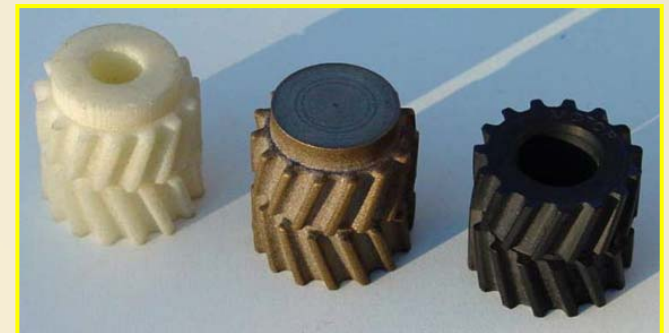


Rapid Prototyping Manufacturing

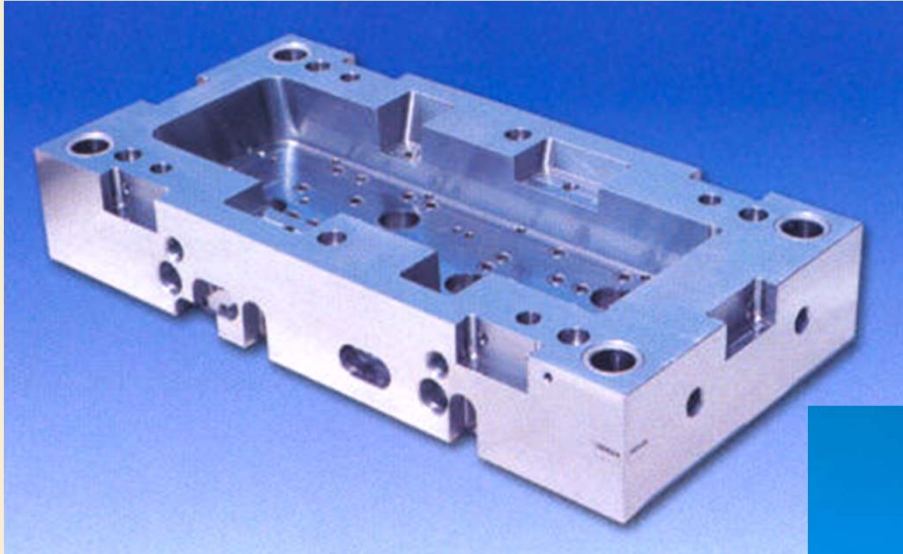
**(1) Develop new products,
Dies and Moulds using
CAD software.**



**(2) Real products, Dies and
Moulds from metals and
plastics.**

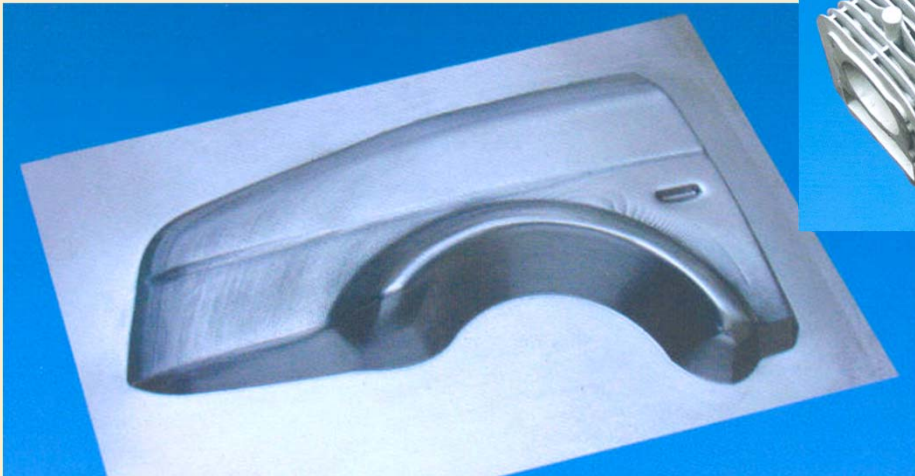
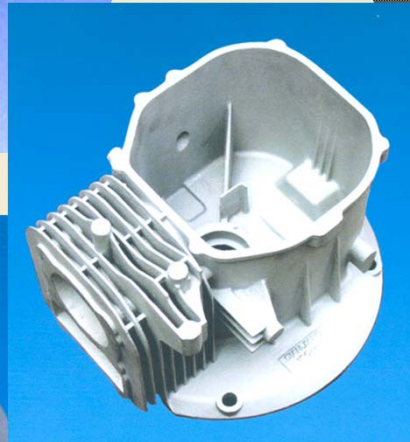


Die Design and Manufacturing



CMRDI is establishing a center of Excellence for Die Design and Manufacturing

Which is the bottle neck of some Egyptian industries.



STDF Funded Projects

- Maximize Value Of Glouconite in Water Purification, Oil Bleaching and Soil Nutrition .
- Reduction Behaviour of Wustite by $H_2/CO/CO_2/N_2$ Mixture at Temperatures in the Range 900-1100 C .
- Derivation of Technology for Production of Titanium Feedstock for Aerospace Industries .
- Quality Assessment and Characterization of Titanium and Titanium Alloys Produced in Egypt

- Energy Saving in High Carbon Ferromanganese Alloy Production .

- Rapid Fabrication of Medical Implants .

- Development of Tungsten Heavy Alloys to Substitute Imports

- Nanostructure Conducting Polymers for Photovoltaic and Electronic Device Applications

- Synthesis of Mordenite Zeolite by Sol-Gel Technique and Study their Applications in the Petroleum Field for Sulphur Removal
- Hexagonal Barium and Strontium Ferrites Nanoparticles for Microwave Absorbance and Magnetic Applications
- Bioactive magnetic materials for hyperthermia treatment of cancer .

Scientific & Technological Cooperation with International Institutions

Country	Institution	Subject of Cooperation
USA	Univ. of Florida	– Preparation of Nano-materials – Phosphate ore flotation – New mineral characterization techniques – Water treatment through Sol-Gel techniques – Processing of Egyptian limestone
	Univ. of Utah	– De-inking of newspapers – Using enzymes in mineral beneficiation – Fine grinding techniques – New process for SO₂ treatment
	Univ. of Wisconsin	– Casting automotive components made of composite materials

(Cont.)

Scientific & Technological Cooperation with International Institutions

Country	Institution	Subject of Cooperation
USA	Univ. of Connecticut	– Production of boron nitride using laser
	Univ. of Kentucky	– Using Falcon technology for treatment of high sulphur Egyptian coal
	Michigan Technol. Univ.	– Using fly ash in foundry sand
	Univ. of Delaware	– Photocatalytic degradation – Synthesis characterization of nano-particles for catalytic applications
Malaysia	SIRIM	– Industrial rapid prototyping – Melting and casting of metals & alloys – New Materials
Bulgaria	Bulgaria Inst. Of Metals	– Production of submerged arc flux – Submerged arc melting & refining – High nitrogen steels
Austria	Austrian Research Inst.	– Cu / graphite composites

(Cont.)

Scientific & Technological Cooperation with International Institutions

Country	Institution	Subject of Cooperation
India	ARCI - Hyderabad	– Advanced materials
	Regional Research Center - Bhopal	– Detoxification of heavy metals from process water using mineral waste
	Indian Inst. of Science - Bangalore	– Bio-processing of minerals
Germany	Paderburn University	– Development of materials
	Aachen University	– Steel and ferro-alloys
	Fraunhofer IW, Freiburg	– Welding of Al alloys
Japan	National Research Inst. Of Metals	– Materials development – Multifunctional and intelligent materials – Laser welding of dissimilar metals
	Japan Welding Inst. Osaka Univ.	– Solid state joining of dissimilar materials (metals / ceramics) – Development of TIG welding tungsten electrodes – Welding of maraging steels

(Cont.)

Scientific & Technological Cooperation with International Institutions

Country	Institution	Subject of Cooperation
Slovakia	Inst. of Materials Research	– Mechanical alloying (ceramics / metal particulate composites)
Ukraine	Physico – Technical Inst. Of Materials & Alloys - Kiev	– Lost – foam casting / production of ductile iron by in – mold process / plasma & electron beam melting and casting technology / bimetallic casting / centrifugal casting of bimetallic pipes and billets / medical implant materials
	Inst. Of Problems of Material Science – Kiev. Titan Institute - Zabarogia	– Development of Al – Si alloys for aviation and airspace applications – Production of pure Si for semi conductors & solar cells – Production of Si metal form sands – Production of Mg from Egyptian ores



Thank You



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