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LKT
Laboratory for Plastics Technology

19466

FINAL REPORT

1st UNIDO/AUSTRIA SECTORIAL CO-OPERATION PROGRAMM ON POLYMER ENGINEERING

AUSTRIA 1991
FINAL REPORT

1st UNIDO/AUSTRIA SECTORAL CO-OPERATION PROGRAMME ON POLYMER ENGINEERING

Organized by the United Nations Industrial Development Organization (UNIDO) in co-operation with the Government of Austria at LKT Laboratory for Plastics Technology to be held from 28 October to 13 December 1991 in Vienna, Austria

by

H. Hubeny
Programme Director

E. Helfert
Assistant Programme Director
1. ACKNOWLEDGEMENT

The LKT is deeply indebted to the following institutions for organizing the programme and for the excellent and successful cooperation.

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Tel: 53120-4219, FAX: 53120-4490

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1200 Wien.
Telephone: 35 35 11 203, FAX: 353511204, Telex: 131824

AUSTRIAN FEDERAL CHAMBER of COMMERCE:
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1040 Wien
Telephone: 50105-0, Telefax: 50206-250

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1200 Wien
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THE COMMUNITY of LITSCHAU/HALGSCHLAG:
Gasteservice Litschau, Stadtplatz 17
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GOLFClUB WALDVIERTEL:
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Telephone: 02865 8441
2. OBJECTIVES

The Sectoral TC-Programme on Polymer Engineering is designed for professionals and newcomers to the plastics processing and application industry as an orientation course lined with bilateral follow-up projects and missions of LKT-staff in selected developing countries or regions.

The programme offers an overview to the whole field of modern achievements in polymer engineering at an industrial - not academic - level aiming at long-term capacity-building and encouraging individual efforts by implementation of specific local and bilateral follow-up activities in plastics processing, plastics application, production management, mould design, quality control, recycling and waste management.

Special emphasis in the programme will be given to improvement of operational activities of existing technical capacities, trouble shooting, as well as on the main aspects related needs of the selected participant. Part of the programme and study visits will be conducted at the plastics industries in Austria. The participants will also have the opportunity to present special topics for discussions in plenary sessions which may relate to problems encountered in their daily work in order to enable the training management to make appropriate adjustments in the programme as far as feasible.

The introductory of the programme will cover a general introduction to the plastics industry, the basic chemical and physical aspects of production of plastic materials, application of plastics processing equipment ans tools as well as equipment used for mould making and testing to promote the introduction of modern processing and production methods in the plastics industry.

Furthermore, the production management and the techno-economic aspects of plastics processing industry, recycling and quality control will also be covered by the programme. The emphasis of the programme, however, will be on providing possible solutions to technical and managerial problems encountered by the participants during their daily work in their respective plants. During the programme adequate time will be devoted to professional discussions related to specific problems.
## 3. PARTICIPANTS

Participants financed from Austria

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>NAME</th>
<th>CONTACT ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>Lyuuali Ngokavili</td>
<td>ENEPA-C.P. 741</td>
</tr>
<tr>
<td></td>
<td>Armando Ndembo</td>
<td>R'Ngola Kilwanje</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Luanda Angola</td>
</tr>
<tr>
<td>Egypt</td>
<td>Mohamed Ismail Omar</td>
<td>National Plastic CO.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shoubbra El KHEMA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Egypt</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Sara Tesfaye Kahsay</td>
<td>ADDIS ABAB . FOAM &amp; PLASTIC FACTORY</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P.O.Box 22971</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Addis Ababa Ethiopia</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Paulo Angello</td>
<td>Ethiopia Plastic Factory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P.O. Box 2340</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Addis Ababa Ethiopia</td>
</tr>
<tr>
<td>Suriname</td>
<td>Herman Sanches</td>
<td>N.V.Consolidated Industries Corporation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Industrieweg Zuid BR 34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P.O.Box 635</td>
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<tr>
<td></td>
<td></td>
<td>Paramaribo Suriname</td>
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<tr>
<td>Trinidad and</td>
<td>Shazai Mohamed</td>
<td>Metal Industries Company Limited</td>
</tr>
<tr>
<td>Tobago</td>
<td></td>
<td>Private Bag 121</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Port of Spain Trinidad, W.I.</td>
</tr>
<tr>
<td>Uganda</td>
<td>Eddie Senkumba</td>
<td>SHIP TOOTHBRUSH Factory Limited</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P.O.BOX 5961, Kampala Uganda</td>
</tr>
<tr>
<td>Uganda</td>
<td>Semom Makumbi</td>
<td>UGAGA Plastic Ltd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P.O. Box 4875 Kampala Uganda</td>
</tr>
<tr>
<td>Zaire</td>
<td>Giselle Mbelu Bayama</td>
<td>TRABET</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 eme Rue, Quartier Industriel</td>
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<td></td>
<td></td>
<td>Kinshasa Limete</td>
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<tr>
<td></td>
<td></td>
<td>B.P. 9010 Kinshasa I Zaire</td>
</tr>
</tbody>
</table>

Selffinanced participants

| Thailand             | Suree Pisithkul           | Thai Plastic and Chemical Co Ltd.    |
|                      |                             | 19 Soi Sukhapital 16                  |
|                      |                             | Poochamunngprai Rd                    |
|                      |                             | Prapudaeng, Samutprakarn              |
4. STAFF

Principal of TGM: Hofrat Dir.Dipl.-Ing. Dr.F.Plockinger

Director of LKT: Regierungsrat AV Dipl.Ing.Dr.H.Hubeny

Assistant Programme Director: Ing.E.Helfert

Organization Committee:

AV Dipl.Ing.Dr.H.Hubeny
Ing.E.Helfert
Ing.M.Pfaffl
StR. Ing.R.Hillisch

Main Lectures:

Prof.Dipl.Ing.Dr.H.Dragaun
Prof.Dipl.Ing.H.Elmecker
Prof.Dr.H.Fischer
Prof.Ing.Dkfm.H.Graf
Ing.E.Helfert
StR. Ing.R.Hillisch
AV Dipl.Ing.Dr.H.Hubeny
Prof.Dipl.Ing. Dr.F.Mayer
Fl. Ing.F.Mennerstorfer
Prof. Dipl.Ing. Dr.H.Muschik
Ing.M.Pfaffl
Ing.J.Schermann
Prof.Dipl.Ing.A.Schmidt
Univ.Doz.Dipl.Ing.Dr.E.Wogrolly
Prof. Ing. Mag.H.Wolanek

Special thanks to all assistance and promotion.
5. **OVERVIEW TIME-TABLE**

5.1. **Theory (Plenary Sessions)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymer Engineering</td>
<td>8</td>
</tr>
<tr>
<td>Plastics Application</td>
<td>8</td>
</tr>
<tr>
<td>Mould Design</td>
<td>8</td>
</tr>
<tr>
<td>Plastics Application</td>
<td>8</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>32</strong></td>
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</tbody>
</table>

5.2. **Practice (Demonstration)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>Compounding and Recycling</td>
<td>8</td>
</tr>
<tr>
<td>Extrusion</td>
<td>8</td>
</tr>
<tr>
<td>Injection Moulding</td>
<td>8</td>
</tr>
<tr>
<td>Quality Control</td>
<td>8</td>
</tr>
<tr>
<td>Trouble Shooting</td>
<td>8</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

5.3. **Project Work (Workshops)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Small group work)</td>
<td></td>
</tr>
<tr>
<td>Injection Moulding and Extrusion</td>
<td></td>
</tr>
<tr>
<td>Planning, processing, controlling, quality control, trouble shooting, evaluation, application, special plant visit, guest lecture, group moderation.</td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>88</strong></td>
</tr>
</tbody>
</table>

5.4. **Follow-up Preparation**

<table>
<thead>
<tr>
<th>Course</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation and discussions of prepared lectures by the participants, project planning, exchange of experience, lectures of participants, final evaluation, group moderation.</td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

**GRAND TOTAL** 180
6. CONTENT

6.1. Overview Theory

Polymer Engineering:

Sustainable Plastics Economy:  ecology and economy  
cycle process  
performance and life time

plastics waste management  
("Kunststoff-Entsorgungstechnik")

Material Science:  classification  
molecular structure  
supramolecular structure  
viscoelasticity

Quality control:  standardization  
test methods

Performance:  time temperature frequency relation  
aging

Processing parameters:  flow behavior  
chemical processes  
shrinkage

Plastics Processing

Principles of Plastics Processing:  classification  
compounding  
discontinuous processing  
continuous processing  
recycling

 Extrusion and Injection Moulding:  design and processing  
parameters  
dimensional stability  
shrinkage  
orientations and stress  
Calculation of case studies
Trends in Plastics Processing: new methods
  automatization:
  material compounds

Mould Design

Principle in Mould and Die Design: elements
  materials (steel, aluminium, others)
  thermal layout
  applied rheology
  computer aided mould design

Injection Moulds: classification
  flow path wall thickness relation
  cavities
  sprue design
  runner design
  gating
  insulated and hot runner

Extruder Dies: layout
  case studies

Plastics Applications: Selected Topics

Rural Application: agriculture
  household
  transport

Packaging: food packaging
  dangerous goods

Engineering: clamp connections
  press joints
  design principles

Pipes and Fittings: water management
  sewage pipes
  gas distribution
  heat transport
6.2. Overview Practice

Injection Moulding
Extrusion
Blow Moulding
Testing

6.3. Project work

Injection Moulding:

Production of test bars with variation of melt temperature and pressure, in order to see the influence of important processing parameters on shrinkage, orientation and mechanical properties. Production of original and recycled polymer. Shrinkage control.

Extrusion:


Testing:


6.4. Special Programme

6.4.1. Fact Finding Preparation (29 November 1991)

H. Hubeny, LKT:
Status of the 1st SECOOP Programme an Polymer Engineering.

V. Byvsuk, UNIDO:
UNDP Project Organization

W. Pilz, Austrian Federal Chancellery:
Principles of the Austrian Development Cooperation

H. Rampitsch, Austrian Federal Chamber of Economy:
Economic Co-operation with Developing countries

R. Langthaler, Austrian Foundation for Development Research:
Aspects of Regional Development
The summary of the mind-maps is shown in Table 1.

**Fact Finding Preparation** (Mind-Mapp-Summary 29 Nov.1991).

**UNIDO-Facilities**
- UNDP Fund: voluntary contribution to developing countries; project basis. five-year-planning: priorities set by governments (plan of government policy); support of private and government sectors, not always full use of the contribution.
- UNIDO Fund: special industrial services for equipment, consultation, quality control, training; direct contribution to factories; limited fund.
- Special Fund: Contributions of governments for special fields or special regions (examples: Danube countries, Africa); examples: Austria SECOOP-Programme in Polymer Engineering.
- Local and Regional Funds.
- Trust Funds: special government contributions (example: Libya, India).
- World Bank: government support for future development.
- Technical Fields: petrochemistry; polymers; materials, quality control, new applications (examples: medical, agriculture), environmental aspects.
- Operational fields: project: establishing centres, factories; nucleus of development: training, equipment, consultation (market, quality control, waste management; studies: regional, national (centres); techno-economic aspects.

Initiatives for project proposals have to come from the companies through the government and the local UNDP-office.

**Austrian Facilities**
- Priorities: Sustainable development (help in the begin, not for 20 years); viable institutions, efficiency; help to the poor.
- Political situation: social stability, democracy, non-violence.
- Programme countries: Africa (examples: Uganda, Tanzania); check of the overall situation, development coordination, NGOs.
- Plastics: justification; future of plastics in the country.
- Collaboration between protected and open market: partnership.
- Austrian Chamber of Commerce (membership oblige, pwervfull export-import promotion: 200 Mio S): Department of Foreign Trade - trade delegates: 90 offices worldwide; support off exports and imports (commercial contacts, request of joint ventures).

Initiatives for bilateral support and development partnership in specific fields have to come from the companies through the Austrian Diplomatic Representative to the Austrian Federal Chancellery. Request for commercial projects and joint ventures has to come from the company through the Austrian Trade Delegation.

The goal of the Overview Programme for the participants is to define and to solve problems now or later, to ask finally the relevant questions and to define the way of action for their specific follow-up activities.

**Table 1: Summary of the mind map**
6.4.2. Lectures of participants

"Learning of each other is a great experience"

9.00 H.Hubeny: Polymer Engineering:
- cooling conditions
- degradation

11.00 S.Pisithkul (Asia): R&D in the field of PVC

12.30 S.Mohamed, H.Sanchez (America): Mould Design
- concepts and experiences
- offers

14.00 P.Angello, G.Bayama, S.Makumbi, E.B.Mandawa, M.I.Omar,
A. Nuembo, E.Senkumba, S. Tesfaye Kahsay (Africa):

Regional Co-operation in Plastic Technology
- experiences
- case studies
- new ideas

6.4.3. Special guest lectures (Injection moulding and Extrusion)

6.4.4. Group Work and Evaluation

6.5. Plant Visit

Grand Plant Visit

Special thanks to all companies for guided tours, support, excellent and
successful cooperation.

The selection of the plants according to the interest of the participants gives a
regional and technical survey on the Austrian plastic industry.

ENGEI.

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A-4311 Schwerin, Austria
Telephone 07262 717141
Telex 02 175142
Telegramme Engel Schwerin

Vienna 12.91
EREMA
Engineering Recycling
Maschinen-Anlagen Ltd

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P.O.B. 36
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Telex: 22300 erema 4
Fax: 0732 31176123

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Werkzeugbau Ltd.

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Telex: 2-103.3
Telefax: 7229 806699

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Koch & Kern & Co OHG

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Poloplaststraß 1, P.O.B. 1
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Telex: 02-131 pololza
Telegram: Poloplast Linz

LENZING AG
Plastics-Machinery
Division Austria

A-4061 Lenzing, Austria
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Telex: 02640 lensoa
Telefax: 07672 2511-78

GREINER INTERNATIONAL

GREINER
INTERNATIONAL
Austria Österreich

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Greinerstrasse 70
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Telex: 24370
Telefax: 24388
Fax: 07563 6248

field: recycling plants,
pelletising machines

field: profil extrusion,
window production,
PVC recycling,
mould design,
mechanical engineering.

field: injection moulding,
extrusion, mould design

field: weaving machines

field: injection moulding,
recycling, mould design,
foam production,
food packaging.
Kunststoffwerk Kremsmünster Ges.m.b.H. & Co KG
Kunststoffwerk Kremsmünster Ges.m.b.H. & Co KG
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Pollman Feinwerktechnik Ltd.
Pollman Feinwerktechnik Ltd
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CINCINNATI Milacron
CINCINNATI Milacron Austrial Ltd
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Postfach 111
Lavendlerstraße 24c
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Telex 734158
Telex 02221 2229

IFW FORMENBAU
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Phone 02221 2229
Telex 02221 2229

BATTENFELD
Kunststoffmaschinen Ges.m.b.H
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Unserersteig 81
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Telex 02232 39 00

THEYSOHN EXTRUSIONSTECHNIK LTD.
A-2100 Korneuburg
Catalanstraße 2
Phone 02232 39 00
Telex 02232 39 00
Telex 113999 THEYSA
7. BACKGROUND PROGRAMME

7.1. PRATERBLUMMEL with Dinner

The "Riesenrad" (Giant Wheel) is a landmark of Austrian Capital and a symbol of the world famous Vienna "Prater". Rising as silhouette to the sky it is seen from far away so the wheel is a special attraction for everybody coming to Vienna. Nobody could properly claim to have been to Vienna unless he had "ridden on the Wheel". In 1896-97 it was built by an English engineer, Walter Basset. Similar giant wheels, constructed by the same engineer, were situated in London, Blackpool and Paris, but they were soon dismantled and sold as scrap-not so this Viennese specimen.

In 1945 all the cabins and whole operating plant were destroyed by bombs and fires, but together with the rest of the Capital the Wheel was started to be rebuilt. Since 1946 it has been in constant action till today.
7.2. Folklore Weekend in the landscape "WALDVIERTEL."

Special thanks to

Frau Elisabeth Bachmann (travel service Litschau)
Frau Maria Pundi (Golfclub Waldviertel)
Hr. Mag. Hermann Holbach (general manager Golfclub Waldviertel)
Elfi (Golfclub Waldviertel)
Luki & Toni (musician)
Hr. Leopold Blaul (hiking guide)
Hr. Hannes Kainz (dancing group)
Ing. Erwin Buhl (museum of Litschau)
Hr. Herbert Schalko (Major of Litschau)
Hr. Johannes Geist (restaurant Perzy)
and the staff from Perzy.
7.3. **SALZBURG** – town of music and art
town of Mozart

December 5th 1991: Bicentenary of his death

Mozart – most famous musician of Austria was born in the town
Salzburg.

The house with the address Getreidegasse 9 was built in the 12th century and it’s
the birthplace of Wolfgang Amadeus Mozart.
It was also in the Getreidegasse apartment that Mozart’s earliest compositions
were written.
7.4. STIFT KREMSMÜNSTER

7.5. YOUNG VIENNA

Visit the most giant disco “Nachtwerk” in Vienna.