

Thermoelectric News

NEWSLETTER OF THE INTERNATIONAL THERMOELECTRIC SOCIETY

XVII International Conference on Thermoelectrics

May 24 - 28, 1998

Nagoya Trade & Industry Center, Japan



We are very pleased to welcome researchers from all over the world with their valuable contributions. We firmly believe that ICT98 will provide significant opportunities to exchange ideas with our old friends, and to make new friends.

Kunihito KUOMOTO, Chairman



Palace for ICT97 Banquet, Dresden, Germany

Inside Thermoelectric News

| | |
|--|----|
| <i>ICT98 in Nagoya, Japan</i> | 2 |
| <i>Editor's Corner</i> | 5 |
| <i>President's Letter</i> | 6 |
| <i>From the Webmaster</i> | 7 |
| <i>Report on the XVI International Conference on Thermoelectrics</i> | 8 |
| <i>Thermoelectrics at the World Conference on Global Warming</i> | 12 |
| <i>ITS Board Members and Information</i> | 13 |
| <i>ITS Membership Form</i> | 16 |

See Report on the XVI International Conference on Thermoelectrics, 26-29 August 1997 in Dresden, Germany by conference chairman, Dr. Armin Heinrich. This meeting was very successful with 248 attendees from 23 countries and 181 paper presentations.



**XVII International Conference
on Thermoelectrics
May 24-28, 1998
Nagoya Trade & Industry
Center, Japan**

Organized by
International Thermoelectric Society Sup-
ported by Aichi Prefectural Government City
of Nagoya
Nagoya University

Conference Objectives

The ICT98 follows the traditional concept of the ICT series and will cover a broad range of topics in thermoelectric research, development and application. The Conference intends to provide scientists, engineers, manufacturers and users with a forum to exchange recent developments in all fields of thermoelectricity.

Conference Topics

ICT98 will provide a forum for presenting and discussing the following topics related to thermoelectric energy conversion:

- * Bulk TE Materials
- * Thin Films and Nanostructured Materials
- * Theory, Modeling, and Simulation
- * Power Generation
- * Cooling
- * Sensors and Detectors
- * TE Measurements
- * TE Devices, Systems and Applications

Call For Papers

Contributed papers for oral and poster presentation are invited for the above-listed conference topics.

Review papers covering topics of current interest are also welcome. Papers will be selected through a reference process, and all papers selected and presented at the conference will be included in the Conference Proceedings.

Abstract Preparation

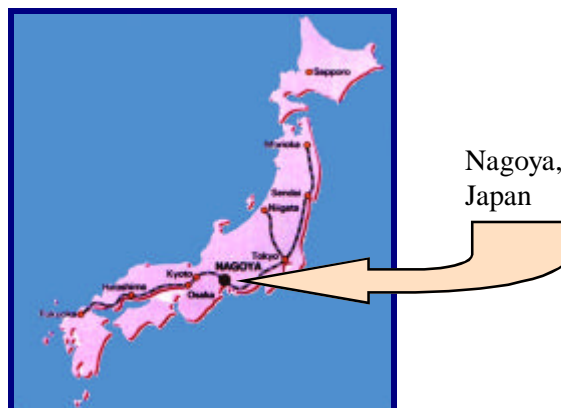
The deadline for abstract submission was January 20, 1998. Therefore, if you are interested in submitting a late abstract for consideration, please contact the conference chairman, Kunihito Kuo-mota at the address given on page 4.

Conference Schedule

The technical program of the conference will be arranged from Monday to Thursday. The first morning will be plenary sessions with invited lectures on selected topics. In the technical sessions that follow not only contributed but also invited papers will be presented. A panel discussion will also be held. For both oral and poster presentations, Best Paper Awards will be given to young scientists at the end of the conference.

The Evening Seminar will be held on Tuesday evening. The seminar features speeches by illustrious scientists, who have contributed greatly to the thermoelectric science and technology. They will give us lectures on the past, present and future of thermoelectrics.

The social program will include a Welcome Reception on Sunday evening, a Mixer on Monday, a Banquet on Wednesday and a Farewell Party on Thursday. In addition, sightseeing tours during the conference will be organized for accompanying guests.



Post-conference Excursion

The Post-conference Excursion will be held on Friday, after the close of the Conference. Participants in the Post-conference Excursion will visit the National Institute for Fusion Science (NIFS), and a traditional workshop for Japanese Paper (Washi) in Mino City and Tempering Japanese Sword in Seki City, and enjoy cormorant-fishing on a boat.

Excursion Schedule:

May 29 (Friday) 1998, 8:30 - 21:30

08:30 - Nagoya
 10:00 - NIFS
 12:30 - Lunch
 14:00 - Workshop for Washi
 15:30 - Workshop for Tempering Japanese Sword
 18:00 - Dinner
 19:00 - Cormorant-Fishing
 21:30 - Nagoya

If you wish to participate in the Excursion, please apply to the Secretariat using the enclosed Registration Form. The fee for the Excursion is 10,000 Yen which includes bus transportation, lunch and dinner.

Venue

Nagoya Trade & Industry Center

2-6-3, Fukiage, Chikusa-ku, Nagoya, 464, Japan

TEL: +81-52-735-2111

FAX: +81-52-735-2116

The city of Nagoya, the nucleus of central Japan, is an industrial metropolis built upon 380 years of history and cultural heritage. The area in and around the City contains a large number of high-tech industries with names known worldwide, such as Toyota, Mitsubishi, Honda, Sony, NGK, Noritake, etc.

(Continued on page 4)



(Continued from page 3)

Nagoya enjoys a temperate climate; agriculture flourishes on the fertile plains surrounding the City. Its central location, made old Nagoya a transportation crossroads, is still an advantage for Nagoya's visitors today. Nagoya is close to an abundance of sightseeing locations. From the beautiful seashores of Ise-Shima and Mikawa Bay to the majestic mountains of the Hida region, and the Japan Alps... all are within easy reach of Nagoya. Japan's systematic transportation network provides links to major cities (Tokyo, Osaka, Kyoto, etc.) in a couple of hours.

The climate in Nagoya in late May is generally pleasant; springtime attire is comfortable. Temperature range is in the low 20's (Celsius).

Exhibition

An exhibition featuring the latest devices and products of thermoelectric companies, as well as products and equipment related to thermoelectricity, will run for the full duration of the conference.

Organizing Committee

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S. Yamaguchi (National Institute for Fashion Science)
K. Kuwabara (Nagoya University)
W. S. Seo (Nagoya University)

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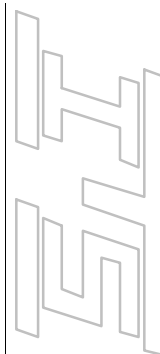
Key Dates

| | |
|--|----------------|
| Abstract Acceptance | February, 1998 |
| Final Announcement & Instruction for Authors | February, 1998 |
| Deadline for Full Paper | May 26, 1998 |

Conference Fee

- * Regular fee includes Proceedings, Welcome Reception, Mixer, Banquet and Farewell Party.
- * Student fee includes Proceedings, Welcome Reception and Farewell Party.
- * The fee of accompanying person includes Welcome Reception, Mixer, Banquet and Farewell Party.

| | <i>Before April 23, 1998</i> | <i>On or After April 24, 1998</i> |
|----------|----------------------------------|---------------------------------------|
| Regular | 50,000 Yen | 60,000 Yen |
| Students | 15,000 Yen | 25,000 Yen |



XVII ICT'98 REGISTRATION FORM

Name:

First name:

Company/Department:

.....

Complete mailing address:

.....

Country:

☎:Fax:

E-mail:

Payment of registration fee by

 bank transfer credit card I plan to attend the conference

I plan to present a paper, I prefer:

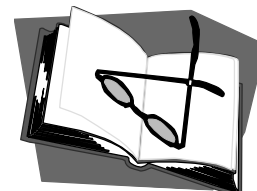
 Oral Presentation Poster Presentation

Registration fees

| | <i>Before April 23, 98</i> | <i>On or After April 24, 98</i> |
|---|--------------------------------|-------------------------------------|
| Regular | 50,000 Yen | 60,000 Yen |
| Student | 15,000 Yen | 25,000 Yen |
| Guest | 25,000 Yen | 35,000 Yen |
| Additional ticket for excursion | | |
| Additional ticket for conference banquet | | |
| Additional copy of conf. proceedings | | |
| Total | | |

Editor's Corner

by Richard Buist



Hello Everyone,

The participation in ICT meetings has steadily increased over the years which is a very good sign for our society and industry. However, I am troubled by the current, unprecedented situation in regards to ICT meetings. That is, as we meet in Nagoya, Japan for the XVII ICT meeting, we have no venue set for any future meetings! In accordance with our society by-laws, the venue for ICT99 should be in the USA but this is only a guideline. Our by-laws allow for the Advisory Board to override this guideline as it sees fit.

This situation is very troubling to me especially in view of the ever-increasing international support of the society by its members. In fact, the overall quality of the latest meeting in Dresden as engineered by Dr. Heinrich and his organizing committee was overwhelming! It also was well-attended by the world thermoelectric community indicating widespread support for our industry.

So, my plea goes out to anyone and everyone who has interest in hosting ICT99 and ICT2000 to submit their proposals to Mike Rowe before the ICT98 meeting in Nagoya. I, for one, will be thankful for your interest and support of these important meetings and your offer host. Whether to "ring-out" the "thermoelectric century" or "kick-off" the next millennium, each of these historic milestones should be an honor for the hosting organization.



Thermoelectric News

Thermoelectric News is produced by volunteer members of the ITS and published by TE Technology, Inc. Contributions for future publications are encouraged and should be sent to:

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President's **L**etter

by

Michael D. Rowe, President of the ITS

I wish members of the ITS and thermoelectricians everywhere a happy and prosperous 1998. It is difficult to appreciate that a year has passed since I informed you that the ITS had received its certificate of incorporation. It is an impressive document, copies of which can be obtained from the Society's Treasurer Dr. B. Mathiprakasam.

The high point of 1997 was ICT97 hosted by the Institute of Solid State and Material Research, Dresden, Germany. 248 delegates from 23 countries took part in the conference, an attendance which has been surpassed only by the 313 at Yokohama in 1993. The conference was held in the Art'otel, (renowned for its unusual although interesting decor) and was an unqualified success due to the excellent facilities and the Chairmanship of Dr. Armin Heinrich. A report of the conference proceedings can be found elsewhere in this newsletter but I would like to highlight one aspect of which I am particularly enthusiastic, namely the best paper awards. The oral presentations and poster papers were of a very high quality again this year and the selection committee found adjudication extremely difficult. However, the awards are primarily intended to recognize high quality work from younger members of the Society and it was unanimously agreed that the best conference papers award should go to Miss R. Martin-Lopez for her oral presentation entitled "Mechanically Alloyed Bi-Sb" and the best poster award to Mr. K Fess for his paper "Transport Properties of the Skutterudite CoSb_3 ".

In spite of the hectic Conference activities, Board Members were able to convene a lunch time meeting. Notable decisions made at this meeting were that Dr. Takenobu Kajikawa succeeded Dr. Jean-Pierre Flurial as Board Secretary. (Dr. Flurial continues as Board Member having hosted the 1997 Conference.) Dr. Cronin Vining was co-opted onto the ITS Board and contracted to operate the ITS web site during 1998. The Board also agreed to the President's proposal that a limited number of ITS bursaries of \$500 be awarded in 1998 to support the attendance of young ITS members at thermoelectric conferences.

(Information available from Dr. B. Mathiprakasam)
The evenings afforded opportunities to sample the culture of Dresden. Organised visits included a boat trip and buffet on the Elbe, a visit to Meissen and a tour around the world famous Dresden Gallery, a memorable experience which was completed with a superb organ recital. The conference ended with the traditional banquet attended by the Deputy Mayor of Dresden. This occasion provided an opportunity for me to present Dr. Cronin Vining with a commemorative plaque as a token of his services to thermoelectrics during his Presidency.

In my previous letter to you I heralded the very welcome news that the United States Department of Defence was to launch a multi-million dollar research program on thermoelectric material research. I envisaged the establishment of a truly international research effort which involved the participation of groups from Europe and the far East. However, I am disappointed to note that all projects will be US lead. Undoubtedly this program will have a profound effect on thermoelectric material development in the United States but I am hopeful that in the future the thermoelectric community at large can benefit from this exciting project.

In spite of my concerns regarding this major program which involves many of the key players in material research, 1998 promises to be another exciting year. A number of research groups have reported significant improvements in material performance and the $ZT=2$ barrier is looking increasingly breachable - will it be achieved this year? On the applications front the news is also positive with Panasonic marketing thermoelectric refrigerators during 1998 commencing with a run of 70,000 units - has the wide scale consumer market for thermoelectrics finally arrived?

The major event this year is ITS 1998 which will be held in the City of Nagoya under the Chairmanship of Professor Kunihito Koumoto. Having visited Nagoya on a number of occasions I can report that Nagoya has something to offer everyone from high tech industries to some of the best examples of Japan's cultural heritage - so do not miss the opportunity to visit this ancient city. For the first time a session on thermoelectrics is to be included in the Forum on NEW Materials of the International Conference on Modern Materials and Technologies (CIMTEC) held in Florence,



Italy. CIMTEC is probably the world's largest material meeting with the Forum comprising 11 symposia and attracting an attendance of several thousand.

Finally, I would like to take the opportunity to remind thermoelectricians that the 1999 conference will be held in the United States. In order to ensure that the Society's interests do not conflict with commercial considerations the conference venue has been restricted to Universities or research laboratories/institutes. Suggestions and bids are invited to host the 1999 Conference and an application proforma can be obtained from me. You may e-mail me at spesgw@cardiff.ac.uk. All bids will be considered by the ITS Board at the Nagoya Conference.

I look forward to meeting you all at Nagoya.

Mike



From the Webmaster

www.its.org

by C. B. Vining, webmaster@its.org

In May 1996 The International Thermoelectric Society established a World Wide Web site to better serve our primary goal: The advancement of thermoelectric industry, science and technology. The site is updated with new information as it becomes available and contributions are always welcome. Stop by and look around!

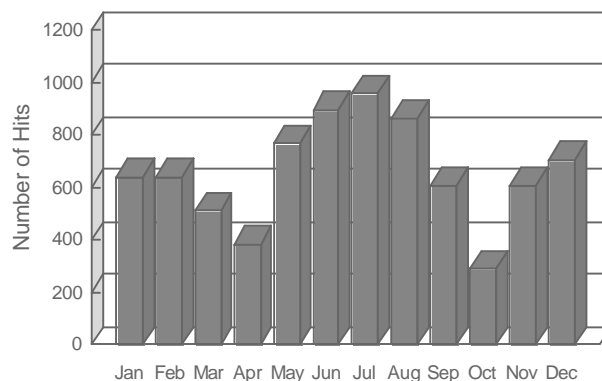
The site typically includes:

- Information about the ITS and the ITS Constitution.
- Online versions of Thermoelectric News - The ITS Newsletter!
- Upcoming ITS Sponsored Conference announcements.
- The 1996 ITS Directory, which can be searched quickly and easily!
- How to get copies of Conference Proceedings
- Visits each month to <http://www.its.org>

The ITS WWW site now averages 27 visits a day. Who comes by? From students doing science fair projects, to curious folks who want to cool their PC or beer, to professionals seeking suppliers, collaborators or conference details. Where do they come from? We've had visitors from Algeria and Bulgaria to Slovakia and Vatican City, 75 different countries so far. What is most popular? The Conference Announcement, Directory, and Newsletter pages are the most visited. 462 million bytes of text have been delivered by the ITS site. Amazing numbers and quite a success for our first full year of operation.

Shameless commercialism - The ITS WWW pages were established by and are maintained for the Society through an arrangement with ZT Services, Inc., an entirely separate commercial venture which, coincidentally, is also dedicated to world-wide growth of the thermoelectric community. ZT Services maintains an additional site at <http://www.zts.com> which provides a collection of any and all thermoelectric-related sites on the WWW and other Internet services such as real-time chat and a News Group dedicated to thermoelectricity. Perhaps our most popular service is zt-spam, an irregular e-mail list delivering tidbits of thermoelectric information painlessly to your inbox. To subscribe, send any e-mail to: subscribe.zt-spam@zts.com or stop by <http://www.zts.com>. If you need more info, or have some questions or requests, write me at: webmaster@its.org. Or, using old-fashioned methods: Cronin B. Vining, ZT Services, Inc., 2203 Johns Circle, Auburn, AL 36830-7113 USA, ph +1-334-887-2404, FAX +1-334-887-2604

ITS WEBSITE VISITS PER MONTH





Report on the XVI International Conference on Thermoelectrics

*August 26-29 1997,
Dresden, Germany*

by Dr. Armin Heinrich

The XVI ICT followed the traditional concept of the ICT series and covered a broad range of topics in thermoelectric research, development and application. A total of 248 scientists, engineers and manufacturers of 23 countries attended the conference. The largest delegations were from Japan (61), Germany (54), USA (40), Russia (24), Ukraine (13), Korea (10), France (8) and Israel (7). The main regions of thermoelectric research were well represented, North America with 42 participants, Asia and Australia with 74 and East and Western Europe with 124. Maybe such a well-balanced attendance is an advantage of an European conference venue.

The technical sessions occupied three days. The program consisted of a daily plenary morning session followed by a total of 16 technical sessions organized in parallel, a panel discussion and two poster sessions. A total of 181 papers were actually presented including 22 invited papers. This was the largest number of presented papers and the second largest attendance within the ICT series. This indicates the increasing interest in thermoelectrics worldwide. The large number of submitted abstracts (more than 200) led us to the decision to organize

two poster sessions with about half of the contributed papers. As a rule, papers which the Organizing Committee expected to be of common interest were scheduled for oral presentation, whereas papers which were expected to stimulate detailed discussion were classified for poster presentation. In addition the authors were asked to express their preference. We may have failed in some cases but we hope all authors have found an interested audience independent of this arrangement.

The technical programme was organized in three main subjects covering the following topics:

(i) State-of-the-art thermoelectric materials

- $(\text{Bi,Sb})_2(\text{Te,Se})_3$ based bulk and thin film materials,
- Bismuth antimony alloys (bulk material and thin films),
- High temperature materials (Si-Ge, tellurides, borides and oxides),
- Silicides (FeSi_2 , Mg_2Si , metal Si alloys).

(ii) Novel thermoelectric materials

- Skutterudites (compounds and alloys),
- Functionally graded materials (Bi_2Te_3 , PbTe , Si-Ge, FeSi_2),
- Composite materials (theory and experiment),
- Two dimensional materials and quantum well structures (experiment and theory),
- New TE materials (low materials, complex structures, intermetallics, rare earth compounds).

(iii) Thermoelectric devices, systems and applications

- Power generation (large scale terrestrial and space applications, utilization of waste heat, analysis),
- Peltier cooling (devices, microcoolers, reliability and testing, new principles),
- Sensors and measurements (thermal conductivity measurement, thermocouples, modeling).



One aim of the programming was to enable a comprehensive presentation of the recent trends and results in search and development of high efficient thermoelectric materials. As known, new attempts have been made in this field over the past four years and very encouraging results have been recently obtained. To allow an appropriate presentation for all attendees interested in these trends, plenary lectures of 45 min were organized in addition to invited talks of 30 min within the technical sessions. For these plenary lectures, three promising fields of materials research were chosen which are different in both the approach and the distance to future applications: (i) skutterudites, (ii) low-dimensional thermoelectrics and (iii) rare earth thermoelectrics.

In the technical sessions, 8 of the 11 invited talks on thermoelectric materials were devoted to novel materials (cluster compounds - Chevrel phases, quasicrystals and quasicrystal approximants, complex chalcogenides, composite mediums, PbTe quantum wells, theory of thermoelectric transport in low dimensional systems, wire array composites, functionally graded TE materials), in 3 papers the current understanding of state-of-the-art materials have been reviewed (chalcogenides for low temperatures, powder processing of Si-Ge alloys, semiconducting silicides).

For the technical sessions devoted to applications we also tried to set up priorities: in the field of thermoelectric generation the use of waste heat and in the field of thermoelectric sensors and Peltier elements the development of microsystems. In three plenary lectures the current state was reviewed of (i) development of thermoelectric power generation systems utilizing waste heat, (ii) Peltier cooling and (iii) sensor applications of thermoelectric thin films. The 5 invited talks about applications reviewed further actual developments on generation (recovery of low temperature waste heat, effective use of untapped thermal energy), measuring (thermal conductivity in thin films, imaging with high lateral resolution) and cooling (complex work of ITC).

The prospects of thermoelectric microsystems for Peltier cooling and TE sensors were also the topic of the panel discussion. The panel was composed of exponents of industry and research institutes. Main points of the discussion were the actual sensor technology and demands on advanced TE materials for application in microcoolers. Thermoelectric microsystems were confirmed to be of growing interest as both thin film and bulk device.

To set up this programme of plenary and invited talks was only possible by the open cooperation of the members of the International Advisory Committee and by the great willingness of the invited speakers. Vicarious for all invited speakers many thanks again to the plenary lecturers,

M.S. Dresselhaus (Cambridge), J.-P. Fleurial (Pasadena), A. W. van Herwaarden (De Delft), T. Kajikawa (Fujisawa), G. Mahan (Knoxville) and J. Stockholm (Vernouillet).

Many further highlights were set by the 159 contributed papers. Only some reports can be mentioned of the great many papers of very high quality: Rare-earth filled skutterudites, Heterostructure integrated thermoionic refrigeration, Epitaxial heterostructures based on layered thermoelectrics, papers on transition metal compounds and on thermoelectric microcoolers. Due to the high quality of the reports we could only find the best paper and post awards by consistent restricting to presentations by young scientists. The best paper award was conferred to R. Martin-Lopez (Ecole des Mines, nancy) for her paper on thermoelectric properties of mechanically alloyed Bi-Sb, the best poster award to K. Fess (University Konstanz) for his paper on the thermoelectric properties of the skutterudite CoSb_3 .

According to the ICT tradition a technical exhibition was held concurrently to the technical sessions featuring the latest devices and products from TE companies as well as products and equipment related to thermoelectricity. 13 companies and research institutes of 6 countries presented their products. For the ICT'97 exhibition TE thin films sensors and generators have been presented for the first time. Many attendees have used the opportunity to contact the developers and manufacturers of TE devices and products and to continue in the mutual exchange of ideas and projects.

Despite the extensive scientific programme there was still time for social contacts to meet friends and colleagues and to become acquainted with the beautiful side of Dresden. A welcome reception was held at the Art'otel on Monday evening. Tuesday night we had a river boat trip with dinner on board and before that a guided tour through the famous part of old Dresden and an organ recital on the Silbermann organ in the baroque Cathedral.



Baroque Cathedral, Dresden, Germany

The conference banquet was held in the castle Eckberg located on the hills which line the northern bank of the river Elbe. There we enjoyed the view over the Elbe valley and the city during sunset.



After entering the castle the vice-mayor of Dresden opened the banquet with a short speech. ITS's president Dr. Michael Rowe followed with an expression of thanks to the former president Dr. Cronin Vining.

Dr. Kunihiro Koumoto gave the announcement of the next ICT conference to be held in Nagoya, Japan. On the last day of the conference a farewell party brought again together most of the participants. Dr. Michael Rowe presented Mrs. M. Rocio Martin-Lopez of Nancy and Dr. Kirsten Fess of Konstanz the best conference paper and poster awards of young scientists.

On Friday morning a visit of the host institute was organized. About 100 attendees used the opportunity to get insight into the recent development of the Institute of Solid State and Materials Research Dresden and to have a look to some thin film, low temperature and X-ray laboratories.



Mrs. M. Rocio Martin-Lopez receives best conference paper award by Dr. D. M. Rowe.



Dr. Kirsten Fess receives best poster award by Dr. D. M. Rowe.

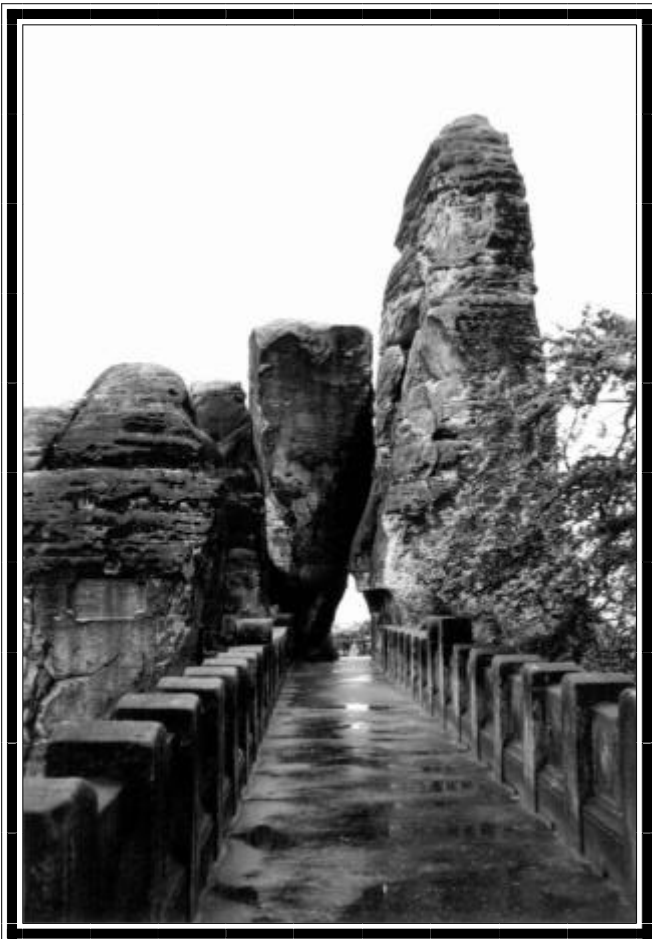


Conference Banquet: From L to R: Dr. and Mrs. A. Heinrich, Prof. Jorg Fink, Mr. Wolgast, and Prof. Mike Rowe.

ITS

Thermoelectric News

On Friday afternoon the visit of the Saxon Switzerland was organized as a post conference tour. About 80 attendees took part in a hiking tour through the very exciting mountains to the south of Dresden. Unfortunately the evening performance in an open air theatre within the mountains fell a victim to heavy rain.



Walkway in Saxon Switzerland, Germany

According to the feedback from many attendees it appears that the ICT'97 was a success. As chairman of this conference I would like to thank all who have contributed to this success. First of all thanks are due to the members of the Organizing Committee for their engaged efforts during many months and the authorities of the host institute IFW Dresden for their continuous support. Thanks also to the members of the International Advisory Committee for their helpful advice and recommendations. I am very pleased to thankfully acknowledge the political support the conference had obtained. We had a word of greeting by the Federal Minister of Education, Science, Research and Technology, and the Saxon Minister of State for Science and Arts was patron of our conference.

Last but not least I want to thank the following institutions for their sponsoring: the Saxon State Ministry of Science and Arts, Deutsche Forschungsgemeinschaft, European Commission - Secretariat General XII, European Office of Aerospace Research and Development of the US Air Force and Components, Packaging and Manufacturing Technology Society (CPMT) of IEEE. Only by the generous sponsoring of these institutions the Organizing Committee was in the position to support many attendees and to organize vital parts of both the scientific and social programme.

International Advisory Committee

J. P. Fleurial (Pasadena, CA, USA)
 H. J. Goldsmid (Kingston Beach, Australia)
 T. Kajikawa (Fujisawa, Japan)
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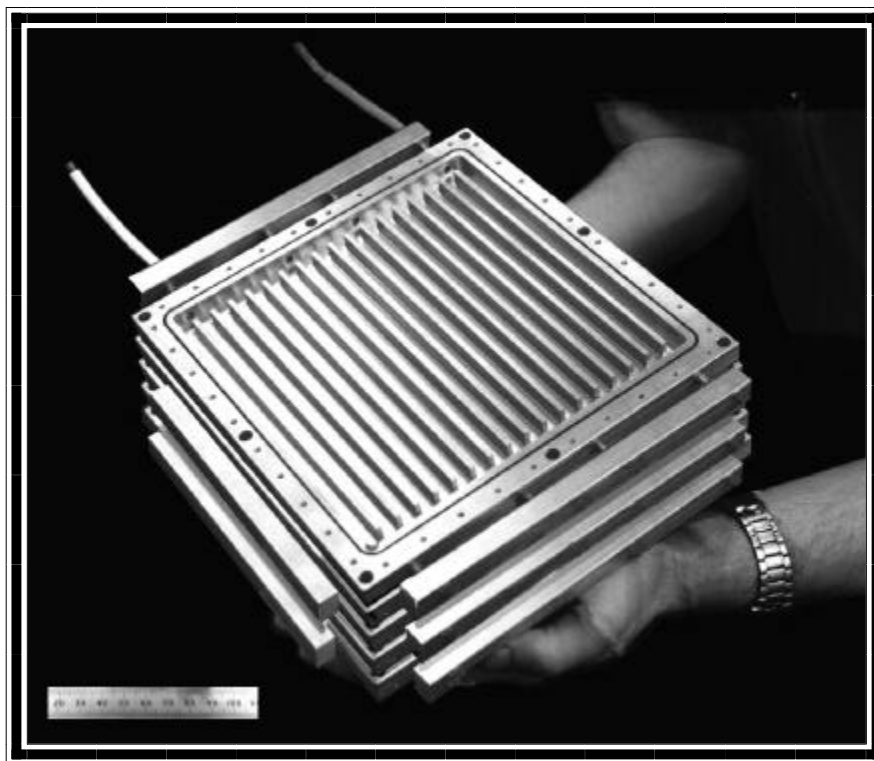
Thermoelectrics At The World Conference On Global Warming

by Michael Rowe

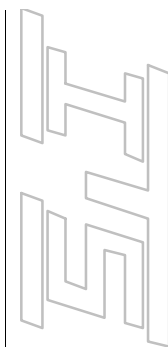
Government representatives from member states of the United Nations converged on Kyoto, one of the ancient capitals of Japan, during the first week of December to attend the third World Conference on Global government, together with Kyoto City agencies, organised an showcase state-of-the-art environmental conservation technology from around the world. The exhibition featured equipment, products and technology from the private and public sectors designed to reduce global warming and other threats to the world's environment. One example of green technology, which attracted wide interest from attendees, was a thermoelectric generator powered by waste heat.

The generator shown in the photograph is referred to as Waste heat Thermoelectric Technology or WATT-100 (the acronym WATT being in honour of James Watt, inventor of the steam engine) and converts the heat in warm waste water at around

90°C to 100 Watts of electrical power which in the exhibition was lighting a fluorescent lamp or driving a cooling fan. To many of the onlookers the production of electrical power from warm water using a device with no moving parts appeared little short of miraculous. The capital cost of the generator is recouped after operating for two years; from then on the cost is only that of system maintenance, which is essentially free. WATT-100 is a prototype "building block" generator which was designed and constructed at the Cardiff School of Engineering, Wales, UK by a team led by Prof. Mike Rowe. This is one activity of a very wide ranging research program to develop improved thermoelectric materials, modules and applications which is supported by the Japanese New Energy Development Organization (NEDO).



WATT-100 TE Power Generator



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The newsletter welcomes advertisements related to thermoelectrics. The rates are 1/4 page - \$50, 1/2 page \$80, and full page \$120. Society members seeking jobs can place free ads (brief). Rates for job opportunities are \$20 for up to four lines.

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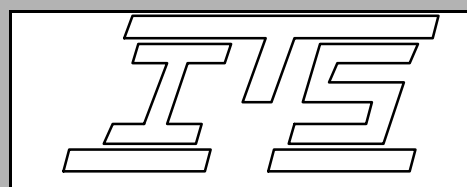




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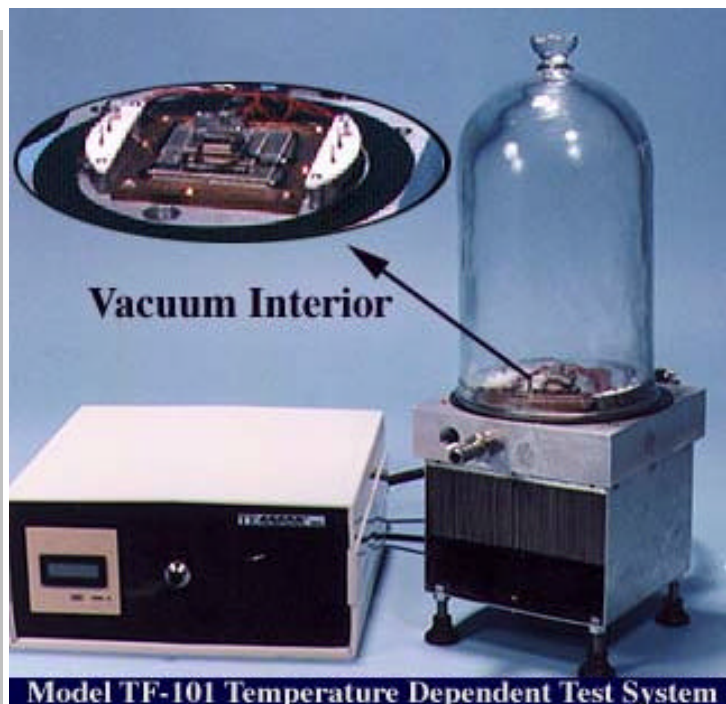


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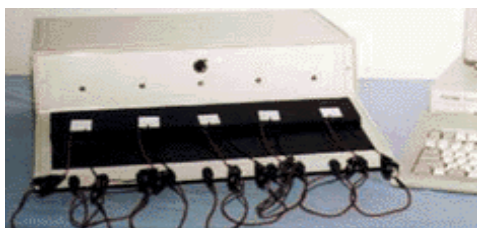
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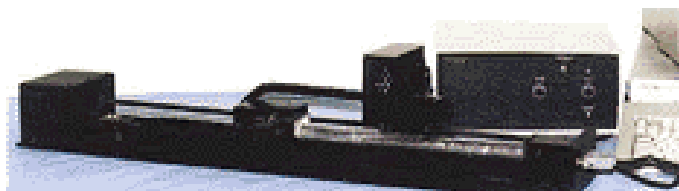
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