# THERMAL HYDRAULICS DIVISION NEWSLETTER

## Fall 2007

**Message from the Chair**

Dear Colleagues:

I am pleased to report that ANS Thermal Hydraulics Division continues to grow very strong, thanks to its robust activities, solid technical programs, and many highly dedicated members and supporters.

With nuclear renaissance on the horizon, US nuclear industry is poised to take leadership in new reactor design, construction and operation. The regulatory and government agencies are engaged in this mission. At this juncture the Division's activities in promoting high quality technical publication, providing forums for presentation on nuclear Thermal Hydraulics, establish, stimulate and maintain quality technical and professional approaches are more relevant than ever to nuclear power industry.

The division has made several key strides in achieving prominence. The THD Technical Achievement Award has been instituted as national ANS award and an endowment fund for this award has been established. I am pleased to state that the first winner of this national award is Dr. Jong Kim of EPRI who will receive this prestigious award during the Awards Ceremony at the ANS Winter Annual Meeting, Washington DC in November 2007.

The Division primary topical meeting NURETH-12 held in Pittsburgh from October 30 to November 4 was a great success. Several Division members served as key organizers of this meeting (Kurshad Muftuoglu, Lawrence Hochreiter, Fan-Bill Cheung, Jong Kim, Joy Rempe and Karen Vierow). It is effort of all the Division members that made this meeting a memorable experience. The Division sponsored or co-sponsored 7 contributed paper sessions with 34 papers presented at the ANS Summer Meeting in Boston. The Division also co-sponsored an Embedded Topical Meeting on Safety and Technology of Nuclear Hydrogen Production, Control and Management at the ANS Summer Meeting in Boston. This topical meeting was another great success. There were total of 55 papers presented in 12 sessions and 4 panels. Participants came from 12 nations and a wide list of industry, labs and universities for the embedded topical meeting. At the winter annual meeting in coming November 2007, the Division has sponsored 7 sessions. The high quality papers presented on timely issues at various meeting continue to attract large audiences and stimulate lively discussion.

The Division has been strong supporter of young members in our Division. The Division is again holding a special session Young Member Paper Competition to stimulate participation from the Division's younger members, at the ANS Winter Meeting in Washington DC this November 2007. The Division continues to support the ANS Student Conferences each year both financially and through Division members' participation.

Our Division membership has shown continued growth over the past several years. Currently, the Division membership is at an all time high at 962. New members have been added to our membership roster and some highly energetic and active members were recruited to our Division's Program Committee and Executive Committee. The composition of our Division membership is more diverse than it has been for long. We have fully complied with the ANS initiative on Professional Division Vitality Measures.

Following the successful NURETH-12 meeting this October another equally important international conference, NUTHOS-7, is being organized. This conference, which attracted a large number of participants in the past, will be held in Seoul, Korea, October 5-9, 2008. See the report on NUTHOS-7 included in this newsletter. The conference home page has been created at http://www.nuthos-7.org/

We just heard sad news during the NURETH-12 meeting that Professor Emeritus Virgil Schrock of University of California Berkeley, passed away on October 1st 2007. He served as a faculty member in the Nuclear Engineering Department since 1948 until he retired in 1991. He continued research activities until recently as Professor Emeritus. Professor Schrock was an active THD member in the past, and he received number of awards including the Division's highest award Technical Achievement Award in 1995. I worked for Professor Schrock for three and half years as a Post-doctoral researcher from 1984 to 1987. He was a great teacher, researcher, mentor and moreover a great human being. He was a respected statesman in our nuclear community and his sudden passing is a great loss to all of us.

Looking ahead, the future of our Division looks as bright as ever with our strong membership and our Division members' active participation in new research programs that are emerging around the world, such as Generation IV and GNEP Programs. The level of enthusiasm and participation in thermal hydraulic sessions and topical meetings is rising. I have benefited greatly from the help and support from my immediate predecessors, Joy Rempe, Bob Martin, Jong Kim, Whee Choe and F. Bill Cheung, and I thank them for sharing their experience and wisdom with me so that I can serve you better. My appreciation is further extended to our EC team

leaders Chang Oh, Karen Vierow, and Kune Suh. It's a great honor and privilege for me to serve you.

Please Visit the THD website for most current information pertaining to our Division's activities. You can find it at http://thd.ans.org.

**Shripad T. Revankar**
Chairperson (2007-2008)
Thermal Hydraulics Division

## Honors and Awards Committee Report

The Thermal Hydraulics Division Honors & Awards Committee has selected Dr. Jong H. Kim of Korean Advanced Institute of Science and Technology , and EPRI as the winner of 2007 THD Technical Achievement Award (TAA). The TAA award is now ANS National Award. Thus for the first time we have Dr. Kim as this prestigious national award winner. The award will be presented to Dr. Kim at the ANS 2007 Winter Meeting. No Fellow or the best paper award was selected for 2007.

### 2007 ANS THD Technical Achievement Award

Winner; Dr. Jong H. Kim , KAIST and EPRI

The Technical Achievement Award is the highest award given by the THD. It is presented annually to a member of the THD in recognition of outstanding past or current technical achievement. It is based on a major contribution to the state of the art, an important publication, a major technical achievement, or a sustained record of accomplishment and technical excellence in the art or science of thermal hydraulics. This year, we are pleased to announce that the TAA will be presented to Dr Jong Kim for his outstanding contributions to thermal hydraulic and heat transfer researches that have helped to resolve ongoing regulatory issues for nuclear power plants.

Dr. Kim received BS in Mechanical Engineering from Seoul National University, two M.S. degrees, one in Mechanical Engineering from University of Missouri, another one from in Applied Physics from Stanford University, and Ph.D. in Mechanical Engineering from Caltech. His professional experience include academics (Caltech and Penn State University), Brookhaven National Laboratory, and Industries (GE, EPRI). He currently holds D.E. Bently & A. Muszynska Endowed Chair Professorship at the Nuclear & Quantum Engineering Dept. at KAIST. He has served as Editor of several international journals. He was elected as a Overseas Korean member of National Academy of Engineering of Korea. He is fellow of both ANS and ASME

**Whee Choe,** choewg@westinghouse.com
2007-2008 Chair
THD Honors & Awards Committee

## Treasurer's Report

For 2007, the Division's income of $18,091 comes from the 2006 carry forward and our member allocation. THD expenses are support for awards and plaques, the student conference at Oregon State University in April 2007, student travel support to the ANS Annual Meeting (June 2007) and the ANS Winter Meeting (November 2007), and scholarships including the NEED program.

| **Revenue** | | |
|---|---|---|
| **Type** | **Item** | |
| Member Allocation | $1/THD Member | 962 |
| Carry Forward from 2006 | | 17,129 |
| **TOTAL REVENUE** | | **18,091** |
| **Expenses** | | |
| **Type** | **Item** | |
| Awards, Plaques | Additional expenses yet to come in 2007 | 60 |
| Student Conference Support | Oregon State Univ. meeting | 3,000 |
| Student Travel Support | June 07 Meeting | 250 |
| Student Travel Support | Nov. 07 Meeting | 250 |
| Scholarship/NEED | Scholarship/NEED and THD award support | 500 |
| **TOTAL EXPENSES as of 9/30/07** | | **4,060** |
| **Balance as of 9/30/07** | | **14,031** |

**Karen Vierow,** Texas A&M University
2007-2008 Treasurer
ANS Thermal Hydraulics Division

## Program Committee Report

As the program committee chair, I am happy to report that we have concluded a very successful NURETH conference. The conference was held at Sheraton Station Square in Pittsburgh, Pennsylvania, September 30 through October 4, 2007. There were more than 200 registrants; the conference attracted slightly less number of participants. The meeting had more international participants than domestic, with representation from 23 distinct countries. Overall, there were 79 U.S. participants and 124 participants from other countries.

The plenary sessions featured presentations from 6 different reactor vendors regarding their plant designs. The Honorary Chair Dr. Novak Zuber gave a plenary lecture where he presented his paper titled "Scaling: From Quanta to Nuclear Reactors". The conference also featured total of 10 invited keynote lectures. In 49 parallel technical sessions, total of 193 papers were presented. With the exception of a few missing

presenters, the sessions were well attended. The paper contributions from each country are listed below.

| | |
|---|---|
| United States | 79 |
| France | 23 |
| Japan | 22 |
| Sweden | 14 |
| Canada | 13 |
| Germany | 13 |
| South Korea | 11 |
| Italy | 4 |
| Switzerland | 4 |
| Hungary | 3 |
| South Africa | 3 |
| United Kingdom | 3 |
| Spain | 2 |
| Taiwan | 2 |
| The Netherlands | 2 |
| Czechoslovakia | 1 |
| Finland | 1 |
| Israel | 1 |
| Russia | 1 |
| Slovenia | 1 |
| TOTAL: | 203 |

Friday was reserved for the technical tour. There were 28 people who participated in the technical tour which included two Westinghouse sites: the Energy Center and the Waltz Mill complex. At the Energy Center, tour members visited the AP1000 simulator. At the Waltz Mill site, the attendees were able to visit a SNUPPS simulator and also see the training facilities for fuel handling, steam generator repair, and field services.

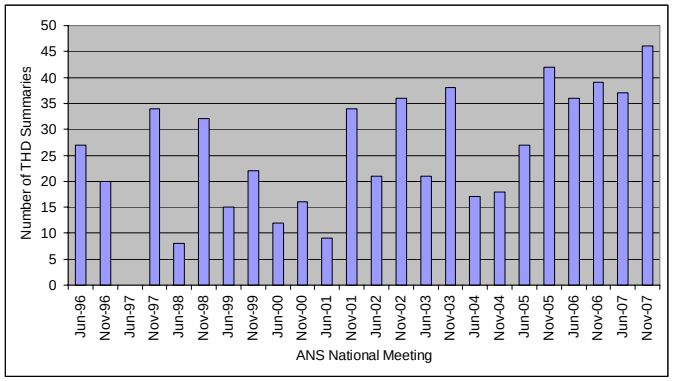
The month of October is typically the month Pittsburgh gets the least amount of precipitation. The weather was extremely cooperative having above normal temperatures during the conference week. The attendees also enjoyed the Station Square surroundings with a nice view of the downtown Pittsburgh.

As we are closing this successful, meeting, we are making preparations for the next one: NURETH-13 conference is announced to be held in 2009 in Japan.

At the Winter Annual meeting in Washington D.C., THD is organizing 7 contributed paper sessions and 1 panel discussion. The sessions are:

- Research Needs and Current Developments in Best Estimate Computational Thermal-Hydraulic Codes—I, Mon. p.m.
- Research Needs and Current Developments in Best Estimate Computational Thermal-Hydraulic Codes—II–Panel, Tues. p.m.
- Thermal Hydraulics of Conceptual and Innovative Reactor Designs, Mon. p.m.
- General Thermal Hydraulics—I, Tues. a.m.
- General Thermal Hydraulics—II, Wed. a.m.
- Young Professional Thermal-Hydraulics Research Competition, Wed. p.m.
- Experiments and Validation in Thermal Hydraulics, Thurs. a.m.
- General Two-Phase Flow, Thurs. p.m.

The winter meeting sessions attracted 46 summaries. This number sets another record for the division. In recent years the THD has been able to present more than 35 papers each in the summer and winter meetings




For the 2008 Annual Meeting (Anaheim California), THD is organizing the following sessions:

1. NURETH-12 Highlights
2. Panel on Thermal Hydraulic Aspects of Nuclear Hydrogen Systems
3. General Thermal Hydraulics
4. Two-Phase Flow Experimentation
5. CFD Analysis of Rod Bundles
6. Thermal Hydraulics of Spent Fuel
7. Thermal Hydraulic Aspects and Licensing of Gen III and Gen III+ Reactors

The announcement for submitting summaries will be distributed later in the year.

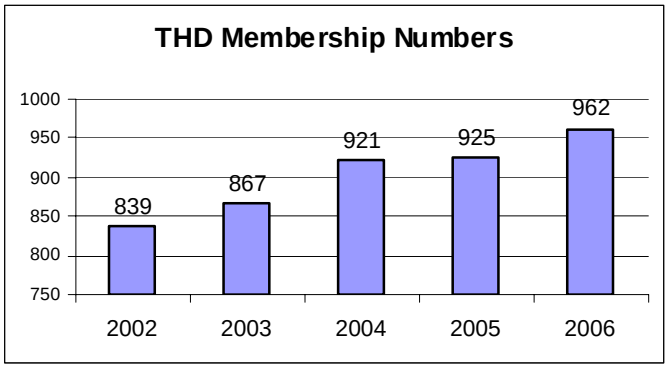
For more information, please visit the ANS website: http://www.ans.org/meetings/index.cgi?c=n. To receive more information on THD meeting activities, to propose a session, or to help with paper reviews, please contact the Division's Program Committee chair.

**Kurshad Muftuoglu,** muftuoak@westinghouse.com
THD Program Committee Chair

## Membership Committee Report

The unofficial mid-year membership statistics show that our Thermal-Hydraulics Division has 942 members. This is slightly down from the end-of-year result from 2006 (962); however, this also reflects the state of flux in membership numbers during the Fall ANS membership campaign (ANS drops unpaid members from the official rolls in July). As such, this is a reminder to members not to ignore the membership renewal notice everyone should've received recently from

ANS! THD has been extremely active the last few years with excellent NURETH meetings and the co-sponsorship of other professional development opportunities. As such, there has never been a better time to be a THD member! If membership trends continue, we expect to top 1000 members during the next year, a number we haven't seen since 1995.




THD welcomes anyone who is interested in thermal-hydraulics and related areas to join the Division and participate in the Division activities. The Division activities include paper review, paper presentations, organizing and chairing technical sessions, sponsoring topical meetings, recognizing worthy candidates for honors and awards, overseeing and participating in all aspects of meetings sponsored by the Division, and supporting student conferences. If you are interested in becoming a new member of our Division or if you would like to participate in any of our activities, please contact any of the Division Officers.

**Robert Martin,** robertp.martin@areva.com
Membership Committee Chair

## Young Professional Thermal Hydraulics Research Competition

The THD is sponsoring a special session entitled "Young Professional Thermal Hydraulics Research Competition" at the November 2007 ANS Winter Meeting in Washington, DC. This is the second installment of the highly successful session that was originally held in June 2006 in Reno, NV.

The professional development session is designed to enhance the technical writing and presentation skills of young professionals working in the area of Thermal Hydraulics through preparation and presentation of an abstract related to the Thermal Hydraulics profession. Accepted abstracts and presentations will be critiqued by a panel of judges that will provide constructive feedback on ways participants can improve their written and verbal communications skills in a technical forum.

All THD members who are less than 36 years old or have less than five years of experience working in the area of Thermal Hydraulics are encouraged to participate. A plaque will be awarded to the participant selected by the judging panel that gave the best oral presentation in the session. All experienced professionals who are interested in judging the presentations are asked to contact the session organizer, Donald Todd.

Finally, THD members are strongly encouraged to attend the session in November. Please come out and show your support to the next generation of engineers working in our field of Thermal Hydraulics. You might even learn a few things, too!

For more information, please see the link below or contact Donald Todd at donald.todd@areva.co*m*
http://thd.ans.org/YP-THRC.doc

## Web Page Report

The THD website (http://thd.ans.org) was completely renovated last year by member Gary Wilson (retired INL). The new layout is easy to navigate and has been regularly updated. It is your source of information for recent and upcoming events sponsored by the THD, author guides, THD committee business, governance documents, contact information of THD officers (both past and present) and THD newsletters. Be sure to visit it as your first source of information on the THD. Your comments and suggestions about content appearing on our site can be directed to me.

**Robert Martin,** robertp.martin@areva.com
Web Site Manager

## Update on THD Governing Documents

To address problems within outdated division governing documents, the national ANS Bylaws & Rules Committee has formulated a new, "Standard Bylaws for Divisions or Technical Groups" that each division must adopt (with minor modifications, such as the name of their division). As noted in the THD Fall newsletter, the THD Executive Committee (EC) discussed these Bylaws and other existing THD governing documents at our Winter meeting. The EC voted to adopt the version of the Standard Bylaws that is now posted on the THD website. In addition, the EC has adopted the updated version of the THD Rules that is also now posted on the THD website, which document the responsibilities of each THD officer and of THD standing committees and their officers. The THD website also contains two additional governing documents, the Manual and the Procedures. The Manual for the THD, which was last updated in 1988, provides historical information about the THD, its mission, it organization, and it honors and awards. The Procedures, which were last updated in 1988, provides more detailed information about the process that must be followed by THD officers with respect to financial transactions and records, meeting reporting requirements, the selection and administration of THD awards, and the coordination of THD topical meetings. As you can imagine, some of the information in the existing Manual and Procedures is outdated because these documents haven't been updated since 1988. At the upcoming Annual Meeting, a draft updated Procedures, which encompasses information from the existing Procedures and Manual, will be discussed. If you have any concerns or comments, please notify one (or all) of

the THD members prior to our June Executive Committee meeting.

Executive Committee
ANS Thermal Hydraulics Division

**NURETH-12 Pictures:**

The Dr. Jong Kim was recognized during NURETH12 meeting award luncheon along with previous ANS THD Technical Achievement Award winners; from left : Drs. Bill Cheung, Novak Zuber, Whee Choe, Neil Todreas, Jong Kim, Richard Lahey, Balaraj Sehgal, Wolfgang Wulf, Vijay Dhir.

Dr. Larry Foulke past ANS president presented a talk during NURETH12 meeting award luncheon

**News Letter Feature: Nuclear Hydrogen**

**Simulation of Sulfur–Iodine Thermochemical Water Splitting Process, Shripad T. Revankar, Cheikhou Kane, Nicholas R. Brown and Seungmin Oh, Purdue University,**
Email: shripad@ecn.purdue.edu

**Nuclear Hydrogen Initiative**
The objective of Nuclear Hydrogen Initiative (NHI) program of the Department of Energy (DOE) is to operate the nuclear hydrogen production plant to produce hydrogen at a cost competitive with other alternative transportation fuels by the year 2017. The NHI program is focused on the Hydrogen production technologies that are compatible with nuclear energy systems and do not produce greenhouse gases. For the hydrogen production technology, several options are considered including steam methane reforming, electrolysis, thermochemical cycles, and high-temperature electrolysis. The steam methane reforming and electrolysis methods are not much interested in the NHI program due to the production of greenhouse gases and low efficiency. The thermochemical cycles and high-temperature electrolysis methods are expected to provide a similar theoretical efficiency in a range of 40-60%. However, the thermochemical cycles are considered as a best suited process with the nuclear heat source in terms of cost of hydrogen production and minimal environmental impact.

**Sulfur Iodine cycle**
Among the thermochemical cycles, a well established Sulfur-Iodine (SI) process developed at General Atomics and first described in the mid 1970's has been considered in U.S., Japan and France for hydrogen production using high temperature heat from nuclear reactor. In a recent NERI supported project SI cycle flowsheet development was carried out using ASPEN PLUS, a commercial available process simulation program.

The SI cycle consists of three chemical reactions expressed as the following equations:
$I2+SO2+2H2O \rightarrow 2HI+H2SO4$ (Bunsen reaction)
$H2SO4 \rightarrow H2O+SO2+1/2O2$ (Sulfuric acid decomposition)
$2HI \rightarrow H2+I2$ (Hydrogen Iodide decomposition)

The first reaction is called Bunsen reaction and proceeds in liquid phase. This reaction produces two kinds of acid, sulfuric acid (H2SO4) and hydriodic acid in solution (HI) from sulfur dioxide (SO2), iodine (I2) and water (H2O). The mixed acid separates into two types of acid of its own accord (liquid–liquid separation). The acid, which is rich in HI, is HIx phase (HIx solution), while the acid, which is rich in H2SO4, is the H2SO4 phase. After separation of the acids, they are purified, concentrated and decomposed in the other two reactions. The second reaction is H2SO4 decomposition reaction that produces oxygen, sulfur dioxide, and water. The third reaction is the HI decomposition reaction which produces hydrogen and iodine. With the exception of hydrogen and oxygen, the other products can be reused in the Bunsen reaction step as the reactant material. The endothermic H2SO4 decomposition reaction can be operated at about 800~1000°C. The decomposition of hydriodic acid involves an endothermic reaction around 400~500 C. The Bunsen reaction occurs exothermically at temperatures of about 100 C. Heat source of two endothermic acid decomposition reactions in the SI cycle can be provided by the nuclear heat as shown in Figure 1 schematically.

Though recently closed loop bench scale SI cycle has been demonstrated that several challenges remain in this technology such as maintaining stable operation ), enhancing the efficiencies of the processes in the cycle, thermodynamic data for the reactions for various operating conditions, coupling to high-temperature nuclear reactor and transient behavior of the coupled SI cycle and reactor. Several alternates to the SI cycles have been proposed in the literature specifically in the

HI and H2SO4 decomposition processes and separation of the product gases.

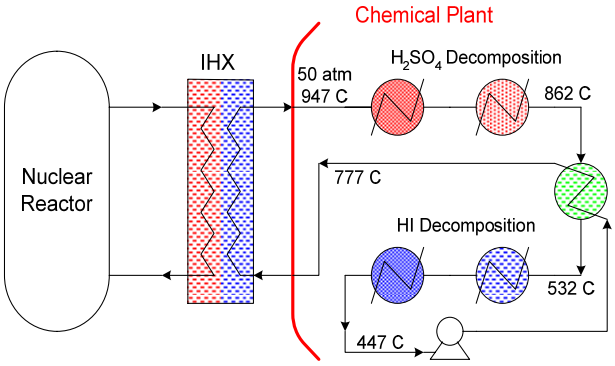



Figure 1. Schematic diagram of nuclear-chemical plant

**Steady State Simulation of SI cycle with ASPEN PLUS**

The SI cycle was modeled with a commercial process code ASPEN PLUS. The present simulations followed the methodology applied to the GA's flowsheet. A step-by-step simulation is conducted. To minimize the convergence problem in a complex system of the SI thermochemical process and to investigate the component-wise characteristics, the simulation is performed initially for the single component such as flash drum, distillation column, and chemical reactor. If adjacent components are converged, then they are combined and simulated. Finally, the simulation for the whole Section is conducted.

For third reaction a Radfrac reactive distillation column is simulated. The proposed flowsheet is shown in Figure 2. The column is constituted by seven stages. The top vapor flows through stage 1. This vapor is, in a first time, flashed in E304 and then the liquid is separated to the vapor in the gas-liquid separator (SEP). The liquid is recycled back, after heated in E305, to the top of the column and the gas flows through the top stream of the separator. The feed stream is set on stage 5 and is at its bubble temperature. The side liquid draw on stage 3 is adopted in this study. In another term, the side liquid extracted from the column is much higher than the side vapor flow rate.

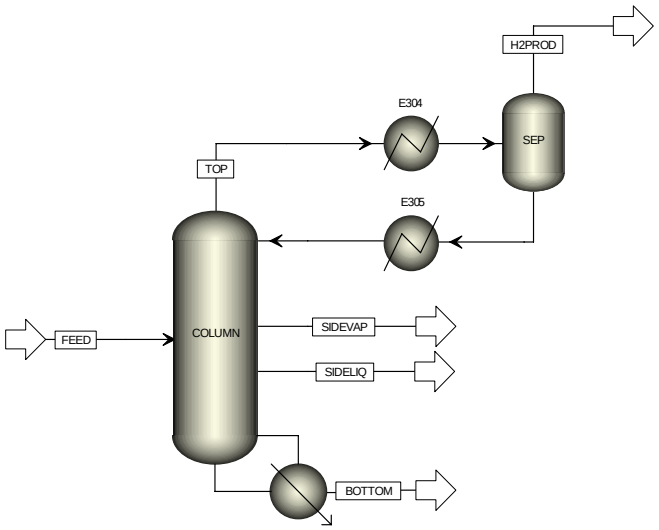



Figure 2. HI decomposition : Flowsheet for the reactive distillation column.

The convergence with the reaction is obtained at 45bars and the side liquid flow rate is equal 50kmol/hr, the boilup rate (BR) is set at 2kmol/hr. Vapor and liquid composition are presented in figure 3.

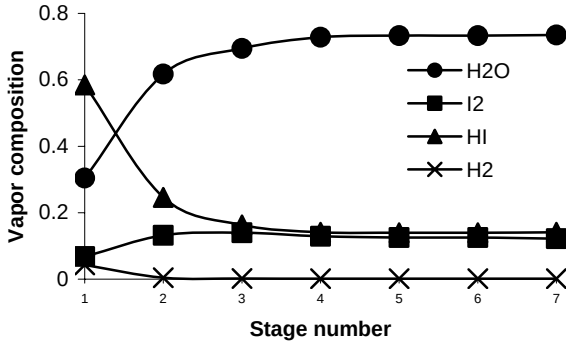



Figure 3 liquid composition in the column under 45 bars, BR=2kmol/hr, DR=5kmol/hr with HI decomposition reaction.

**Simplified SI Model for Transient Simulation**

Since the Bunsen reaction is exothermic this process does not need any high temperature heat source. Therefore, this process has no interface with the helium stream. Both acid decomposition reactions are coupled to a nuclear reactor via a series of heat exchangers such as the pre-heater, the evaporator, and the chemical decomposer as shown in Figure 4. In this model, only one decomposer for each section is modeled for the thermal balance analysis. The pre-heater and the evaporator are assumed to be operating at a known temperature during transient and its heat load is simply calculated from the energy balance.

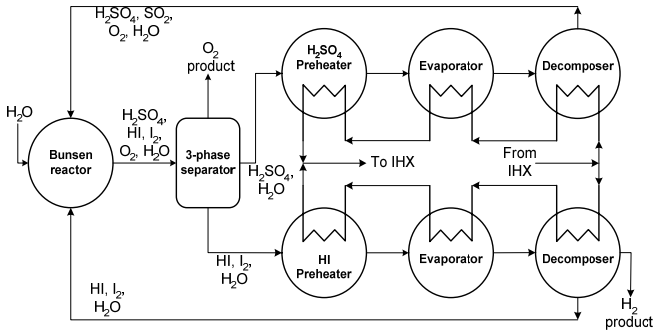



Figure 4 Simplified Sulfur-Iodine cycle

Several transient calculations that have been performed rely on straightforward perturbations of the heat transfer through the heat exchanger, Q, such as temperature or flow rate on either side of the heat exchanger. In this paper, transient calculations are focused on reactor loop driven transients through the heat exchanger, by perturbation of steady state temperature and flow rate. In this paper, no feedback and response of the reactor loop is considered.

From experience developing, evaluating, and solving these models, it is determined that there are two distinct regions in a given model transient response: Driving force region

And Plant response region

One driving force is shown in Figure 5, a 50 Kelvin ramp increase in hot side of heat exchanger loop. The driving force and response are indicated by regions on the plot.
One interesting result is the difference between the length of the response region for reaction 2 and 3. Due to the large reverse reaction rate in HI decomposition reaction , it takes thirty times longer for the section response to converge. This behavior is illustrated in Figure 6.

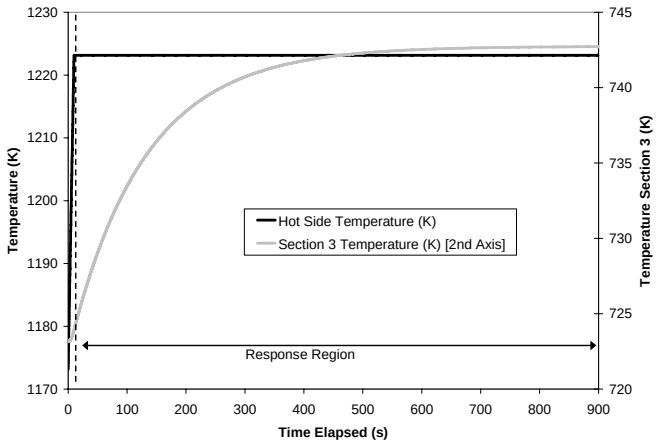



Figure 5 Section III driving and response regions 50 K ramp increase

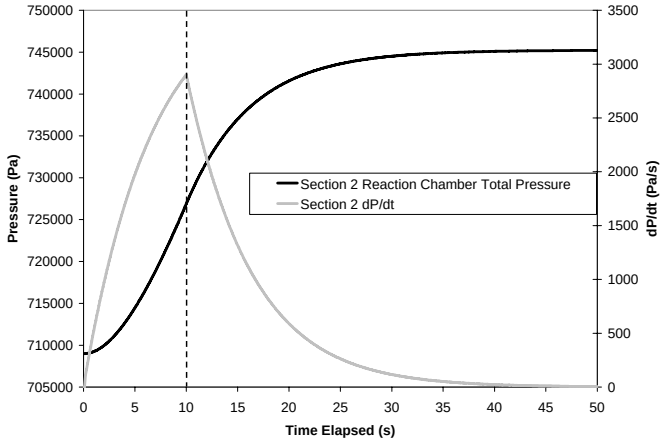



Figure 6. HI decomposition reaction pressure response 50 K ramp increase

## Nominating Committee Report

Results from the recent ANS elections are official! We have the following new Division Officers and Executive Committee members.

### Executive Committee (3 year term)

**Current Year THD Officers:**
**DivisionChair:** Shripad Revankar,*shripad@ecn.purdue.edu*
**Vice Chair:** Chang Oh, *chang.oh@inl.gov*
**Treasurer:** Karen Vierow, *vierow@ne.tamu.edu*
**Secretary:** Kune Suh, *kysuh@snu.ac.kr*

### Executive Committee Members

| | |
|---|---|
| Kurshad Muftuoglu (2010) | *muftuoak@westinghouse.com,* |
| Xiadong Sun (2010) | *sun.200@osu.ed* |
| Jong Kim (2008) | *jkim@epriww.com* |
| Fan-Bill Cheung (2009) | *fxc4@psu.edu* |
| Whee Choe (2009) | *whee.choe@txu.com* |
| Yassin Hassan (2009) | *y-hassan@tamu.edu* |
| Hisashi Ninokata (2009) | *hninokat@nr.titech.ac.jp* |
| Don Todd (2009) | *donald.todd@areva.com* |

In addition, this year we have added the following new members to the Program Committee

Cesare Frepoli, Westinghouse Co.
Donna Guillen, Idaho National Laboratory
Seungjin Kim, Penn State University
Theron Marshall, Idaho National Laboratory
Brian Woods, Oregon State University
Steven Arndt, US Nuclear Regulatory Commission
Pradip Saha, General Electric

The Nominating Committee is responsible for the nomination of THD members to leadership positions on both the Program and Executive Committees. The THD would like to encourage members interested in becoming more involved to contact one of the officers listed above. In particular, the division is usually in need of volunteers for technical meeting session organizers and paper reviewers.

**Joy Rempe** Joy.Rempe@inl.gov
2007-2008 Chair
THD Nominating Committee

nuthos-7.org

Second Announcement & Call for Papers

# NUTHOS-7

The 7th International Topical Meeting on
Nuclear Reactor Thermal Hydraulics, Operation and Safety
October 5-9, 2008, Grand Intercontinental Hotel, Seoul, Korea

## Invitation

Nuclear energy continues to be faced with major challenges such as waste, economics, proliferation and last, but not least, safety. The Three Mile Island and Chernobyl accidents have underscored the importance of safety design and operation to the future use of nuclear power. With the preamble of evolutionary and revolutionary concepts around the globe including, but not limited to, the Generation IV Nuclear Energy Systems and Global Nuclear Energy Partnership, multilateral R&D opportunities are being explored in multidisciplinary fields. NUTHOS proves to be an important series of international topical meetings in the area of thermal hydraulics, operation and safety of nuclear power plants. NUTHOS has provided the global nuclear community with an open forum where premium state-of-the-art information is exchanged among the specialists and executives. Now the seventh of the series, NUTHOS-7, calls for the up-to-the-minute knowledge and leading-edge research results from both hemispheres. It is our greatest pleasure to welcome you all to this momentous congress.

## Suggested Topics

- Single- and Two-Phase Flow Dynanamics and Heat Transfer
- Mathematical and Computational Methods, Theory and Validation
- Computational Fluid Dynamics Application and Validation
- Porous Media Approach and Subchannel Analysis
- Thermal Hydraulics of Steam Generators and Heat Exchangers
- Thermal Hydraulics of Power Conversion Systems
- Thermal Hydraulics and Safety of Advanced Reactors
- Thermal Hydraulics and Safety of Containments
- Thermal Hydraulics of Plant Power Uprating
- Thermal Hydraulics of Waste Management and Spent Fuel Repository

- Advances in Measurements and Instrumentation and Control
- In-Core Fuel Management
- Plant Load-Follow Strategies
- Plant Operation, Retrofitting, and Maintenance Experiences
- Plant Monitoring and Diagnostics
- Plant Licensing Renewal and Continued Operation
- Plant Simulators, Analyzers, and Operator Training
- Application of Digital Engineering Technology to Plant Operation
- Application of Artificial Intelligence, Expert Systems, and Robotics
- Steam Generator Operation and Maintenance

- Beyond Design Basis Accident Analysis and Management
- PSA Applications to Design, Operation and Maintenance
- Risk-Informed and Performance-Based Regulation
- Safety Culture and Related Organizational Aspects
- Proliferation Resistance and Physical Protection

## Organizers

· **Honorary Chair**
Prof. Neil E. Todreas (MIT)
Dr. Mamoru Akiyama (IAE)

· **General Chair**
Prof. Soon H. Chang (KAIST)
Dr. Dae J. Wang (National Tsinghua U)

· **Organizing Committee**
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## Important Dates

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| December 17, 2007 | Summaries Due for Review |
| January 21, 2008 | Notification of Acceptance |
| February 25, 2008 | Full Manuscripts Due for Review |
| April 28, 2008 | Notification of Acceptance |
| June 16, 2008 | Camera-Ready Manuscripts Due |
| August 25, 2008 | Pre-Registration Due |
| October 5-9, 2008 | Conference |

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