THERMOELECTRICITY: THE ART OF WASTE HEAT RECOVERY

Overview

The shortage of energy resources is the main problem of recent times. More than half of the energy consumed worldwide is wasted as heat. The recovery of small fraction of this waste heat can change the global energy scenario. Thus thermoelectricity has become significant in the field of waste heat recovery. It is also advantageous for localized cooling of microelectronic systems for its ability to maintain its efficiency in small scale dimension. However, the major problem associated with thermoelectricity is the low efficiency of commercially available materials. Recent progress in thermoelectric research has enabled researchers to develop new materials with enhanced thermoelectric efficiency. The efficiency of a thermoelectric material is defined in terms of a dimensionless parameter, $ZT = \frac{\sigma^2 T}{\kappa}$, where $\sigma$ is the Seebeck coefficient, $T$ is the electrical conductivity, $T$ is the absolute temperature and $\kappa$ is the thermal conductivity. So, to enhance $ZT$, the value of $\sigma$ and $\kappa$ must be enhanced with a simultaneous reduction in $T$.

In this course discussion will be made on different strategies those could be adopted to increase the thermoelectric figure of merit by independently enhancing the value of the various parameters with an emphasis on the nanstructuring systems.

Goals and Objectives

- Building confidence in the minds of students and/or faculty members from academic institutions in learning the techniques of waste heat recovery by using thermoelectric effects, the materials used and their characterizations.
- Creating interest on various aspects of materials and their structures including thin film materials for the application of waste heat recovery.
- Imparting technical knowledge in developing modules for waste heat recovery using the principle of thermoelectric effect.

Venue

IIT Kharagpur and its extension centers at Bhubaneswar and Kolkata through online video lecture. All video-conferencing enabled classrooms at Kharagpur, Kolkata and Bhubaneswar are equipped with high definition video-conferencing system. Each of these acoustic treated air-conditioned video enabled classrooms with multiple HD cameras, document viewers and large display monitors permit teachers to conduct LVE interactive sessions from Kharagpur with multiple remote classrooms at Kolkata and Bhubaneswar. 8 Mbps leased line connectivity of Kolkata and Bhubaneswar centers with Kharagpur ensure uninterrupted bi-directional lossless audio video transmission.

Course Schedule and Methods

5.00 – 7.00 PM on Fridays and 10.30 AM – 12.30 PM on Saturdays.

Eligibility

Category - 1 (AICTE Sponsored / TEQIP Sponsored): Faculty from AICTE approved Colleges / Institutions / Universities.

Category - 2 (Student / Industry / others): B.E. / B.Tech. / AMIE / Diploma in Engineering / B.Sc. / M.Sc. or any other qualification in relevant field.

Important Dates

Last date for receiving application: June 30, 2015
Intimation to the applicants: July 15, 2015
Course duration: November 6, 7, 20, 21, 27, 2015
Course Contents

1. Introduction to thermoelectric effect: Figure of Merit, its dependence on Seebeck coefficient and resistivity of the materials.
2. Review of the art of waste heat recovery with special emphasis on the materials and temperature regime.
3. Different strategies to enhance the thermoelectric figure of merit: carrier energy filtering, mass fluctuation and endotaxial nanostructures.
4. Resonance of the impurity level and impurity band induced transport.
5. Thermoelectric generator, Numerical problems and questions.

The Faculty

Prof. Pallab Banerji is currently a Professor in Materials Science Centre, Indian Institute of Technology, Kharagpur. He teaches various courses related to electronic materials for energy and photonic applications in both undergraduate and postgraduate levels. His primary interest is on thermoelectric and photovoltaic phenomena in materials, low dimensional structures and devices. He has supervised several M.Tech. and Ph.D. theses.

Registration Fees

Category-1: Nil (for TEQIP Institutions)
Category-2: ₹ 500 (For IIT Kharagpur Students)
Category-3: ₹ 5000* (For Industry/Self Sponsored)

To confirm participation please send the scanned copy of the Demand Draft to pallab@matsc.iitkgp.ernet.in by 30 June 2015 positively.

Accommodation

Outstation participants will be provided accommodation at IIT Kharagpur on self payment basis as per availability on prior request.

Course Co-Ordinator

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