

# 智慧熱管餘熱回收節能關鍵技術開發計畫

執行單位

核能研究所

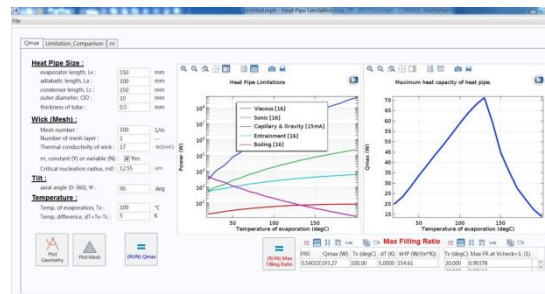
計畫主持人

李恆毅

- 計畫總目標：建置kW級智慧熱管低溫(300°C以下)餘熱回收節能測試與展示系統，同時藉發展熱管電腦輔助設計系統，建立100 kW級以上系統的規畫設計能力，並協助鋼鐵、石化、水泥、資源回收和其他產業提升能源效率。

## 專利佈局：

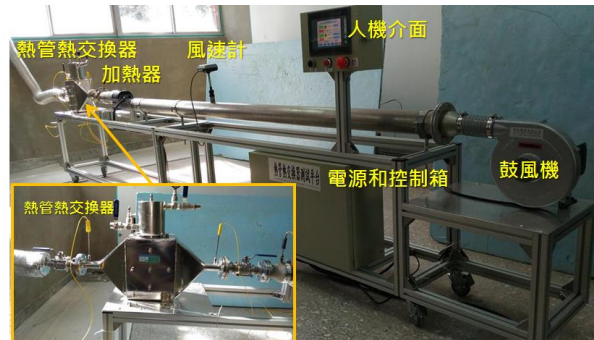
- 「高效能廢熱回收熱管內部結構」，此種熱管結構具有較強傳熱能力與較佳毛細力之優點，中華民國專利已獲證，美國專利申請中。
- 「利用紅外線熱影像檢測熱管品質之裝置與方法」，此技術可以全面線上快速整體檢測，中華民國專利和美國專利申請中。
- 「熱管除氣和封口的裝置與方法」撰寫中。



熱管電腦輔助設計程式



熱管的製作與量測



1 kW熱管熱交換器及測試平台

■ **計畫介紹**：針對國內耗能產業在300°C以下的低階餘熱回收仍有極大開發空間，但是面臨酸露點腐蝕、堵灰、空間不足、維護困難等問題。為此，本計畫開發智慧熱管餘熱回收節能系統與高效能熱管關鍵技術，發展具有耐腐蝕、防堵灰、高效、緻密、智慧熱管理等特色，使我國工業節能得以落實。

■ **發展現況**：目前已建立以下關鍵技術

◆ 熱管和熱管熱交換器的電腦輔助設計技術，熱管內壁孔洞塗層製程技術，熱管外壁電漿鍍膜技術，熱管品質快速檢測技術。

■ **成果說明**：

◆ 台灣熱管理協會2017年度會員大會暨技術成果發表會-熱管之熱傳限制及最大熱傳量系統分析-最佳論文

◆ 「2017台北國際發明暨技術交易展」競賽區-逆流熱虹吸向下傳熱裝置(中華民國發明第I548854號)-銅牌獎

◆ 技轉收入476仟元，技服收入225仟元，促進投資5,000仟元，增加就業5人。

最佳論文獎獎狀



發明競賽銅牌獎

# Key technology development of smart heat pipe waste heat recovery energy saving system

Execution Unit

Institute of Nuclear Energy Research

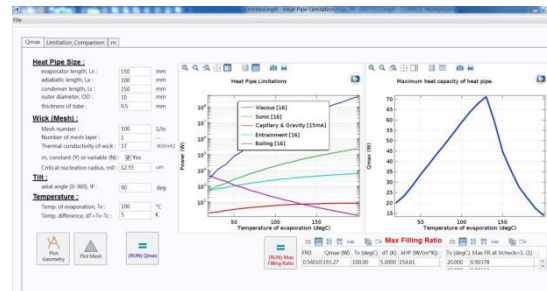
Project Director

Heng-Yi Li

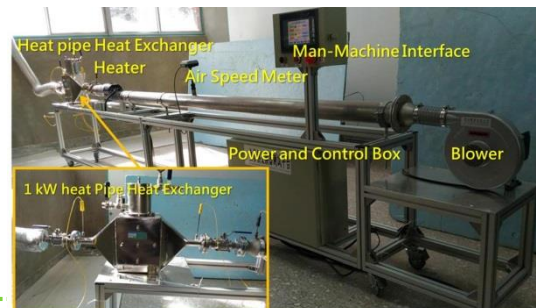
- The overall objective of the project: To build up a intelligent waste heat recovery energy-saving testing and demonstration system for kW-level heat pipes below 300 ° C, to design systems larger than 100 kW by developing heat pipe computer-aided design systems, and to assist steel, petrochemical, cement , resource recovery and other industries to improve energy efficiency.

## Patent Portfolio:

- Heat Pipe with Inner Zeolite Coated Structure.
- Apparatus of Heat Pipe Quality Detection Using Infrared Thermal Imager and Method Thereof
- The apparatus and method of degassing and sealing for heat pipe



Computer aided design program for heat pipe



Manufacture and measuring of heat pipe

1 kW heat pipe heat exchanger and test platform

**Project Description:** In Taiwan, the below 300 °C low-grade waste heat from energy-consuming industries still has great space left for heat recover, but the problems of flue gas dew point corrosion, ash blocking, insufficient space, difficult maintenance and other issues still wait for a total solution. Therefore, the goal of this project is to develop a proposed smart waste heat recovery energy-saving system assisted by heat pipe, as well as the key technologies of highly-effective heat pipe which has the characteristics of corrosion resistance, anti-clogging, high effectiveness, compactness and smart thermal management, thus to enable the full utilization and recovery of Taiwan's industrial waste heat energy.

**Present achievement:**

Currently, the following key technologies have been established: Computer-aided design technology for heat pipe and heat pipe heat exchanger , heat pipe interior coating technology, heat pipe exterior coating technology, and method of rapid detection on heat pipe quality.

**Outcomes:**

- ◆ The paper of “Analysis of heat transfer limitation and maximum capacity for Heat Pipe” got outstanding research paper award in Annual Meeting of Taiwan Thermal Management Association and Technical Achievements Presentation 2017.
- ◆ The patent of “Device of Downwardly Transferring Heat through Reverse Thermosiphon Loop (Taiwan invention patent of ROC No. I548854)” got bronze medal award of invention contest in Taipei International Invention & Technology Exhibition 2017.
- ◆ Technology transferred income is NT\$476,000 , technical service income is NT\$ 225,000 , promoting industry investment is NT\$ 5,000 ,000, and help employment of 5 persons.

Outstanding research paper award



Bronze medal award of invention contest