

Keynote Lecture 1

Thermodynamic property measurements of next generation refrigerant blends

Prof. Yukihiro Higashi



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Prof. Yukihiro Higashi carried out his undergraduate studies at Keio University, Yokohama, Japan, and received his Ph. D. in Engineering from Keio University, March 1986 (Supervisor: Prof. Koichi Watanabe). The title of his dissertation is “Experimental Study of the Vapor-Liquid Coexistence Curve for Halogenated Hydrocarbons and Their Mixtures in the Critical Region”. From 1987 to 2016, he was working at Iwaki Meisei University, Fukushima, Japan. Since 2016, he is a professor of Research Center for Next Generation Refrigerant Properties (NEXT-RP), International Institute for Carbon-Neutral Energy Research (I2CNER), Kyushu University. In 1998-1999, he was a guest researcher of National Institute of Standards and Technology, Department of Commerce, Boulder, CO, USA.

His interests are focused on thermodynamic properties measurements for refrigerants and their blends. He measured PVT properties, vapor pressures, saturated densities, vapor-liquid equilibrium, and surface tension for refrigerants. He had already determined the critical parameters for 21 pure refrigerants and 40 binary/ternary refrigerant blends. The critical parameters he determined are now used in many equations and correlations including REFPROP. The current target of his research is the low GWP refrigerant and their blends. In NEXT-RP, he is continuing their measurements with domestic and international collaborations.

He is a member of IIR, Commission B1, and an International Advisory Board of International Journal of Refrigeration (IJR). He is also member of JSRAE and JSTP (Japan Society of Thermophysical Properties). Now he is the President of JSTP.

Awards:

- 1991. 8 Sadi Carnot Award, International Institute of Refrigeration (IIR)
- 2011. 8 Best Paper Award 2009/2010, International Journal of Refrigeration, Elsevier.
(First author : Prof. Ryo Akasaka)
- 2013. 9 Asian Academic Award, Japan Society of Refrigerating and Air Conditioning Engineers (JSRAE), The Chinese Association of Refrigeration (CAR), The Society of Air-Conditioning and Refrigerating Engineers of Korea (SAREK)
- 2015. 8 Best Paper Award 2014/2015, International Journal of Refrigeration, Elsevier.
(First author : Prof. Chieko Kondou)

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To prevent further deterioration of global warming and ozone layer depletion, CFCs (Chlorofluorocarbons), HCFCs (Hydrochlorofluorocarbons), and HFCs (Hydrofluorocarbons) have also been subject to refrigerant regulation in Kigali Amendments. The development of the next-generation refrigerants to replace the regulated refrigerants becomes an urgent task. NEXT-RP (Research Center for Next Generation Refrigerant Properties) is an academically neutral research institute established in I²CNER, Kyushu University, to search for low GWP (Global Warming Potential) refrigerants with safe, non-toxic, non-flammable, and environmentally acceptable. At present, NEXT-RP is collaborating with 17 universities and national laboratories in 5 countries to evaluate new refrigerants (Fig. 1). Our main target for new refrigerant is in HFOs (Hydrofluoroolefins) having a carbon-carbon double bond. Although there are still many remaining issues in terms of stability and flammability, there is a movement to search for a new refrigerant from refrigerant mixtures to solve the weakness. I am going to talk about our NEDO project related to the assessment of next-generation refrigerant blends and recent results for new binary/ternary blends of *PVT* properties, saturated densities, vapor-liquid equilibrium, and critical parameters.



Fig. 1 International collaboration of NEXT-RP, I²CNER, Kyushu University. (as of 2020)

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