

Research Center for Next Generation Refrigerant Properties (NEXT-RP)

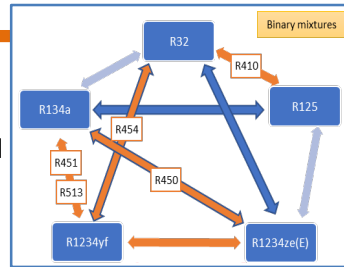
WPI-I²CNER, Kyushu University



The Research Center for Next Generation Refrigerant Properties (NEXT-RP) was established within I²CNER on April 1, 2016.

NEXT-RP Mission

1. Determine thermophysical properties of next generation refrigerants and thermal science and engineering to help enable the most effective use of these refrigerants in carbon-neutral-energy technologies.
2. Research new thermal energy heat pump and refrigeration systems which are focused on the use of new refrigerants and which will result in improved overall energy efficiencies and reduced CO₂ emissions.
3. Organize an international collaboration network in order to obtain reliable information on thermophysical properties and to establish the worldwide standard for next generation refrigerant properties.



Background of Next Generation Refrigerants

Beginning in the 1930s, Appearance of novel refrigerants
 → CFC (ChloroFluoroCarbon) and HCFC (HydroChloroFluoroCarbon)

Problem: (1980s) Ozone Layer Depletion

Solution: Appearance of non-chlorine fluorocarbons
 → HFC (HydroFluoroCarbon) refrigerants and their mixtures

Problem: (2000s) Global Warming

Solution: Appearance of Low GWP Refrigerants
 → HFO (HydroFluoroOlefin) refrigerants and their mixtures

Problem: Flammability and Safety

At the present, our task is to find out the following next generation refrigerants:

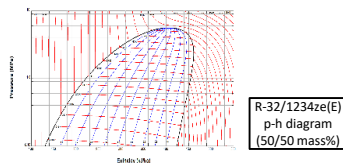
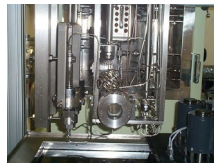
- (1) Low ODP (Ozone Depletion Potential)
- (2) Low GWP (Global Warming Potential)
- (3) Non-flammable or Mild flammable
- (4) No toxicity

Paris Agreement
 Kigali Amendment
 MOP 28, COP 22

Research Divisions

(1) Division for Thermophysical Properties and Transfer Processes of Next Generation Refrigerants

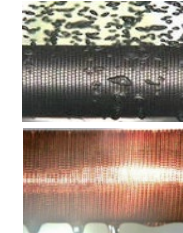
Thermodynamic and transport properties of next generation refrigerants are essential for the design and development of new refrigerators and heat pumps. We measure the reliable thermophysical properties for new refrigerants and mixtures thereof, and propose highly accurate equations of state and correlations for use in the analysis of the transfer process.



R-32/1234ze(E)
 p-h diagram
 (50/50 mass%)

(2) Division for Heat Transfer and Refrigeration Cycles

In order to adapt next generation refrigerants for use in heat pumps and refrigeration instruments, we carry out analysis, not only of heat transfer for several types of heat exchangers, but also of the cycle performance of heat pumps and refrigeration that uses pure refrigerants and mixtures thereof.

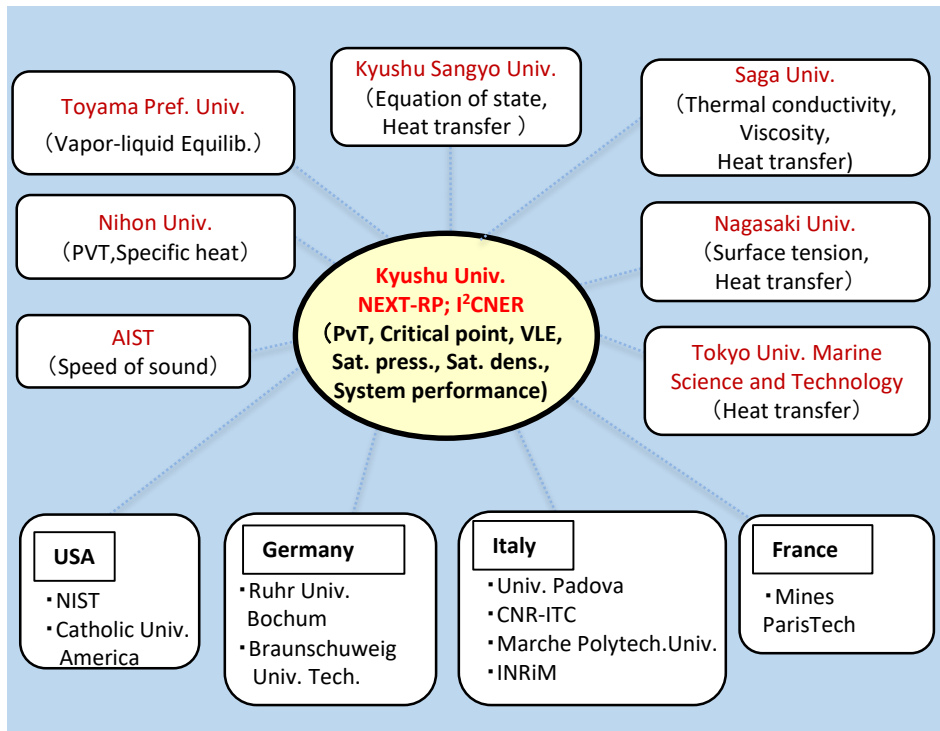


(3) Division for Refrigerant Property Information and Academia-Industry Collaboration

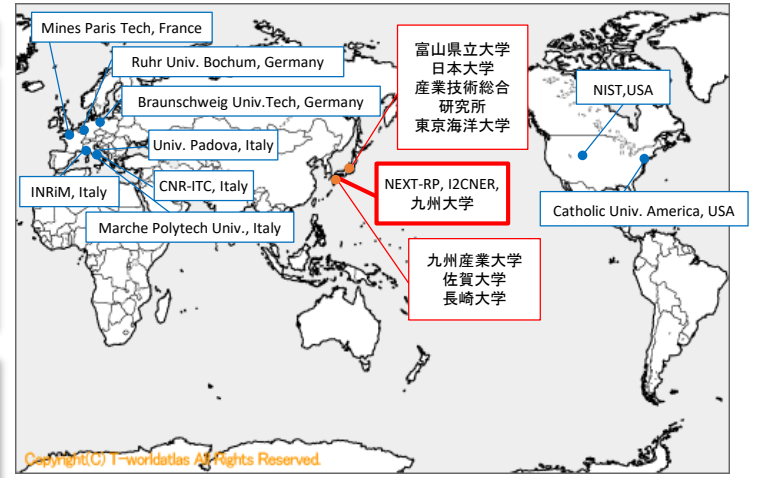
Data obtained by divisions (1) and (2) are compiled into a database, and the data are transferred using user-friendly software.

International collaboration is established amongst Japanese researchers and other researchers at international universities and research institutes.

Network of Collaborations and Organizational Structure



- Director: Prof. Yasuyuki TAKATA
- Division for Thermophysical Properties and Transfer Processes of Next Generation Refrigerants**
Prof. Yukihiro Higashi
Prof. Akio Miyara
Prof. Ryo Akasaka
Prof. Naoya Sakoda
Prof. Chieko Kondou
 - Division for Heat Transfer and Refrigeration Cycles**
Prof. Takahiko Miyazaki
Prof. Kyaw Thu
Prof. Akio Miyara
Prof. Chieko Kondou
 - Division for Refrigerant Property information and Academia-Industry Collaboration**
Prof. Ryo Akasaka
Prof. Yasuyuki Takata
Prof. Bidyut Baran Saha



Kick-off Meeting at NIST 2013. 10. 10.



Workshop at Univ. of Padova 2014. 12. 2.



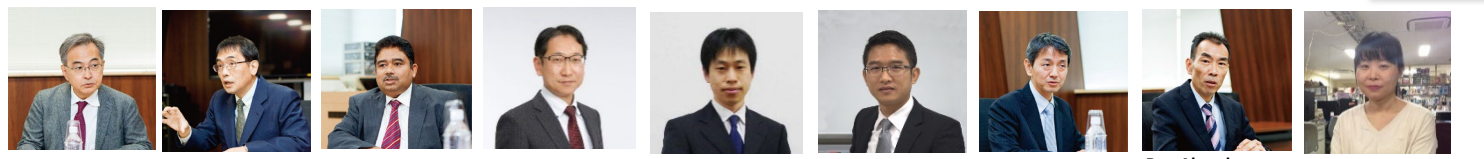
After Workshop in ICR 2015 2015.8.19



Workshop at Mines ParisTech, 2017. 12. 14.

International Workshop History

- #1 October 2013 Kick-off meeting NIST, Boulder, CO USA
- #2 December 2014 Univ. of Padova, Vicenza, Italy
- #3 August 2015 ICR2015 at Pacifico-Yokohama, Japan
- #4 December 2016 Univ. of Padova, Vicenza, Italy
- #5 December 2016 Marche Polytech Univ., Ancona, Italy
- #6 December 2017 TU Braunschweig, Braunschweig, Germany
- #7 December 2017 Mines ParisTech, Paris, France
- #8 November 2018 Mines ParisTech, Paris, France
- #9 November 2018 Marche Polytech Univ., Ancona, Italy



- Yasuyuki Takata**
Director of NEXT-RP/
Associate Director of I²CNER/
WPI Professor and Principal Investigator
- Yukihiro Higashi**
WPI Professor
- Bidyut Baran Saha**
WPI Professor and Principal Investigator
- Takahiko Miyazaki**
WPI Professor
- Naoya Sakoda**
WPI Associate Professor
- Kyaw Thu**
WPI Associate Professor
- Akio Miyara**
WPI Visiting Professor/
Professor, Saga University
- Ryo Akasaka**
WPI Visiting Professor/
Professor, Kyushu Sangyo University
- Chieko Kondou**
WPI Visiting Professor/
Professor, Nagasaki University



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