Research Center for Next Generation Refrigerant Properties I²CNER, Kyushu University

NEXT-RP Mission

- 1. To measure and evaluate thermodynamic and transport properties of next generation refrigerants
- 2. To formulate accurate equations of state and correlations
- 3. To establish an international collaboration network to obtain reliable thermodynamic information

Background of Next Generation Refrigerants

CFC (ChloroFluoroCarbon) and Appearance of novel refrigerants during the early 1930s HCFC (HydroChloroFluoroCarbon)

roblem: Ozone layer depletion (1980s)

Appearance of non-chlorine fluorocarbons

HFC (HydroFluoroCarbon) refrigerants and their mixtures

Solution:

Appearance of low GWP refrigerants

Problem: Global warming (2000s) ► HFO (HydroFluoroOlefin) refrigerants and their mixtures

Problem: Flammability and Safety

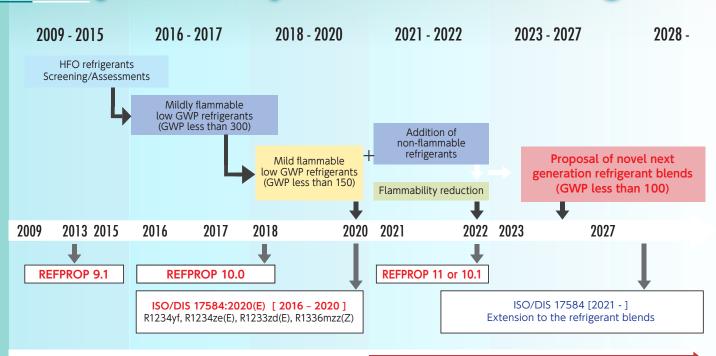
At the present, our task is to find the following next generation refrigerants:

(3) Non-flammable or Mildly flammable

(1) Lower ODP (Ozone Depletion Potential) (2) Lower GWP (Global Warming Potential)

(4) Lower toxicity

Roadmap for the Development of Next Generation Refrigerants



Heat Transfer and Cycle Performance Evaluation

*These researches are supported by NEDO projects "Development on High Efficient and Non-Freon Air Conditioning System (2016-2017)" and "Development Techniques for Next-Generation Refrigerant with Low GWP Values (2018-2022)"

Research Center for Next Generation Refrigerant Properties (NEXT-RP) International Institute for Carbon-Neutral Energy Research (I²CNER), **Kyushu University**

744 Motooka, Nishi-ku, Fukuoka 819-0395 JAPAN TEL & FAX: 092-802-6704 MAIL: next-rp@i2cner.kyushu-u.ac.jp WEBSITE: https://i2cner.kyushu-u.ac.jp/~next-rp







Procedure for Identifying Next Generation Refrigerants at NEXT-RP

Screening and selection of new candidates for next generation refrigerants

(1a) Thermodynamic property measurements

Critical parameters
Vapor pressures
Saturated densities
PvT properties
Vapor-liquid equilibrium
Specific heat
Speed of sound

(1b) Transport property measurements

Thermal conductivity Viscosity Surface tension Additional measurements, Improvement of EoS

(2) Formulation of equation of state (EoS) Making the FLD file (REFPROP)

NIST REFPROP installation as international standard

Additional measurements, Improvement of EoS

Requirements of next generation refrigerants

- (1) No ODP, (2) Low GWP, (3) No toxicity, (4) No flammability,
- (5) High performance,
- (6) Low cost and others...

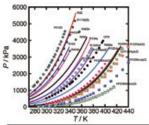
(3) Heat transfer analysis of several heat exchangers (Evaluation of heat transfer coefficients)

(4) Evaluation of the performance of refrigeration/heat pump cycle

(5) Proposal of expecting new refrigerants:

Next generation refrigerants





	TIK	
		 HFE356mmz R1336mzz(Z)
	• R1123	 R125 R1336mzz(E)
R134a R1234y1	 R1243zf R1224yd(Z) 	 R455A R1132(E)
	# P12002d(E)	CF3I

NEXT-RP Research Collaboration Map



NEXT-RP Members



NEXT-RP Director Yasuyuki Takata Professor I²CNER Principal Investigator Kyushu University



Yukihiro Higashi Professor Kyushu University



Takahiko Miyazaki Professor Kyushu University



Naoya Sakoda Associate Professor Kyushu University



Kyaw Thu Associate Professor Kyushu University



Akio MiyaraProfessor, Saga University
I²CNER Visiting Professor



Ryo Akasaka Professor, Kyushu Sangyo University I²CNER Visiting Professor



Chieko Kondou Professor, Nagasaki University I²CNER Visiting Professor