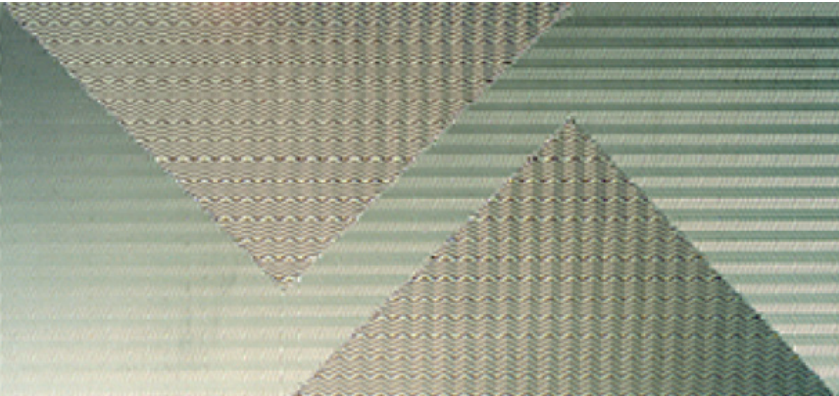


# PCHE Heat Exchanger Technology

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- Technology related to a micro channel heat exchanger with higher surface area density compared to existing products
- Heat transfer plates where flow channels are chemically etched on are stacked to create one solid body type of core through diffusion bonding, and by welding inlet/outlet type of headers on the core, then, a heat exchanger is completed.



### Client / Market

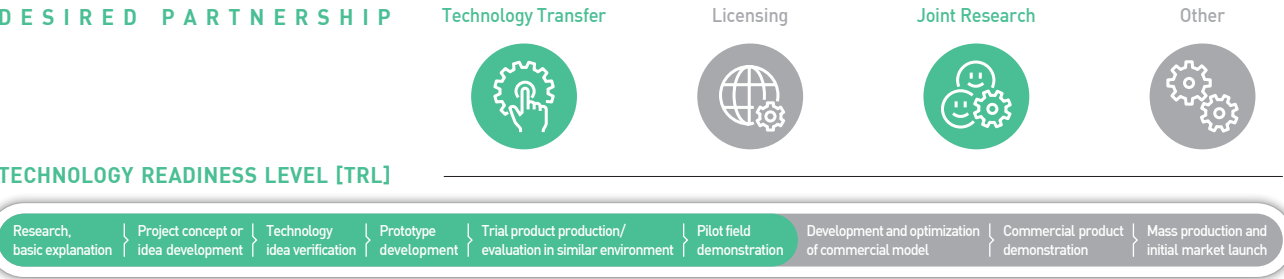
- Used for two– and single–phase heat exchange, and waste heat collection at power plants, steel mills, chemical plants, etc.
- Large plants or other places needing a large capacity heat exchanger

### Necessity of this Technology

- Existing shell & tube heat exchangers have a low surface area density (100 m<sup>2</sup>/m<sup>3</sup>) that they are limited to be used when a high surface area density is required.
- Currently, industries depend on the products of advanced foreign companies (e.g. Heatric of England, VPE of the US, KOBLECO of Japan, etc.).
- Development of heat exchangers with a high surface area density to be used under a high temperature and pressure is needed.
- Independently own techniques need to be secured.

### Technical Differentiation

- Cost is high, but the volume can be reduced while operating under a high temperature and pressure.
- With the high surface area density, it can be used at wide range of temperature (–250℃ to 800 ℃) and a high pressure (up to 50 Mpa).



- Domestic technology for a high value–added heat exchanger is secured.
  - Diffusion bonding
  - Heat exchanger fluid path and capacity design
- Know–hows accumulated through bonding experiments, fluid path channel design, and heat exchanger experiments

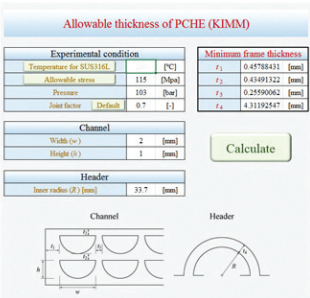
### Excellence of Technology

- Can be used for a wide temperature range
- High compressive strength (up to 50 MPa)
- Equipped with diffusion bonding technology
  - Bonding know–how and data secured
  - Vacuum furnace for bonding design
- Equipped with technology for PCHE design based on heat exchange capacity
  - Design know–how and data secured
  - PCHE size design depending on the single– and two–phase heat transfer
- Developed a program estimating the tolerable wall thickness of PCHE
  - Developed based on the ASME boiler & pressure vessel code
  - Calculating not only the minimum allowable wall thickness itself, and wall thickness between channels but also the most outer wall thickness and the header thickness by comparing the stress of each channel wall with allowable stress under a given pressure

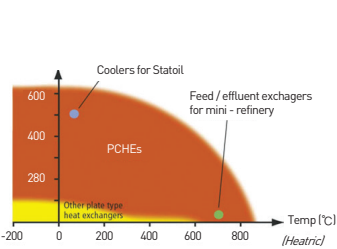
Vacuum Furnace for Diffusion Bonding



PCHE Wall Thickness Tolerance Estimation Program



Temperature/Pressure Range



### Current Intellectual Property Right Status

#### PATENT

- Micro Channel Heat Exchanger (KR0991113)
- Vacuum Apparatus for Diffusion Bonding (KR1034858)
- Vacuum Apparatus for Diffusion Bonding (KR1094961)
- Micro Channel Heat Exchanger (KR1080236)
- Micro Channel Heat Exchanger (KR1202773)
- Vacuum Apparatus for Diffusion Bonding (KR1167626)
- Vacuum Apparatus for Diffusion Bonding (KR1220300)