

**NOTE:** Page numbers used in this Index refer to the **FIRST PAGE** of the referenced article published in the proceedings. To view the referenced article, go to the Table of Contents and click on the article with the referenced page number located to the left of the paper title.

## Cryocoolers 16 Subject Index

- Active Space Tech. (Portugal), 583  
ADR (*see* Magnetic refrigerators)  
Adsorption vs pore size in carbons, 567  
AIM Infrarot-Module (Germany):  
  pulse tube coolers, 133  
Air Force Research Lab (AFRL):  
  comp. of TEC and Stirling-type coolers, 327  
  coolers for microsatellite applications, 709  
  inertance tube and reservoir modeling, 249  
  prognostic health management system, 655  
  thermal comparison of two 2-stg PTs, 291  
Akari (Astro-F) space mission coolers, 1  
Applications of cryocoolers (*see* Integration with cryocoolers)  
Applied Tech. Assoc., 2-stg PT comparison, 291  
Astrium (*formerly* BAe and MMS), 121  
ATK Aerospace Sys., cryogenic heat pipe, 557  
Atlas Scientific:  
  PT with integrated circulator, 591  
Ball Aerospace coolers:  
  10K hybrid Stirling/J-T cooler, 13  
  cryogen boil-off reduction system, 601  
Bearings, flexure springs (*see* Compressors)  
Brayton cryocoolers (*see* Reverse-Brayton coolers)  
British Aerospace (BAe) cryocoolers (*see* Astrium)  
CEA/SA (Saclay, France), 689  
CEA/SBT (Grenoble, France):  
  15K PT cold fingers for space, 45  
  IXO 50mK sorption ADR stage, 537  
  LN<sub>2</sub> energy storage units, 583  
  sorption coolers on Herschel, 689  
  SPICA/SAFARI sub-Kelvin cooler chain, 699  
  thermal storage using triple point of H<sub>2</sub>, 575  
CEFITEC (Portugal):  
  cryo adsorption vs pore size in carbons, 567  
  LN<sub>2</sub> energy storage units, 583  
CFIC-QDrive:  
  30 W 50 K coaxial PT with tapered tube, 163  
Chiba University (Japan):  
  active magnetic regenerator modeling, 523  
  effect of charge pressure on GM perf., 71  
Clearance seals (*see* Compressors)  
Clever Fellows Innovation Consortium (*see* CFIC-Qdrive)  
CNES (Toulouse, France):  
  SPICA/SAFARI sub-Kelvin cooler chain, 699  
  thermal storage using triple point of H<sub>2</sub>, 575  
Compressors:  
  advanced Brayton compressor, 391  
  clearance seal loss analysis using CFD, 353  
  drive electronics for (*see* Drive electronics...)  
  efficient low-vibration GM compressor, 371  
  moving magnet linear compressor, 361  
  oil-free compressor for GM coolers, 375, 385  
  thermoacoustic comp for 300 Hz operation, 343  
Convection, gravity effects on PT perf., 6, **183**  
Create, Inc.:  
  2 K ADR for remote cooling, 515  
  4 K hybrid Brayton/J-T cooler, 35  
  advanced Brayton compressor, 391  
Cryomech 4K pulse tube cryocoolers:  
  operation with inverter compressor, 65  
Cryosurgical probes, 731  
CryoWave Adv. Technology, Inc.:  
  thermoacoustic expander for J-T systems, 497  
Diaphragm compressor for GM cooler, 375, 385  
Dilution refrigerators (*see* Sub-Kelvin coolers)  
Drexel Univ., PT processes, 219  
Drive electronics for coolers:  
  for moving magnet linear comp, 675, 681  
  modular linear-drive electronics, 667  
Electronics, cooler drive (*see* Drive electronics...)  
Energy storage (*see* Thermal Storage)  
Erbium regenerator materials (*see* Regenerators)  
Etched foil regenerator mat'l (*see* Regenerators)  
European Space (ESA/ESTEC) activities:  
  IXO 50 mK sorption ADR stage, 537  
  sorption coolers on Herschel, 689  
Exergy flows (*see* Pulse tube theory and invest.)  
Flexure bearing springs (*see* Compressors)  
Figures of merit for cryocoolers, 645  
Flir Systems, rotary cooler vibration, 623  
Flow in regenerators (*see* Regenerators)  
Flow loops (*see* Remote cryogenic loads, cooling of)  
Flow management in pulse tubes (*see* Pulse tube theory and investigations)  
Gadolinium nitride (*see* Magnetic coolers)  
Gas-gap heat switches (*see* Heat switches)

- Georgia Institute of Tech.:  
 boundary layer effects in miniature PT, 267  
 hydrodynamic parameters in oscill. flow, 411  
 heat transfer during transient flow, 419  
 impact of regenerator structural flaws, 281
- Gifford-McMahon Cryocoolers:  
 effect of charge pressure on GM perf., 71  
 efficient low-vibration GM compressor, 371  
 oil-free compressor for, 375, 385  
 PT operation with inverter compressor, 65
- Goddard Space Flight Center (NASA):  
 ADR for Micro-X sounding rocket, 547
- Gravity effects on high-freq PT perf., 6, **183**
- Heat exchangers:  
 J-T heat exchanger configuration effects, 455  
 pressure drop in slit type heat exchanger, 201
- Heat switches:  
 thermal switching cryogenic heat pipe, 557
- Herschel space mission, sorption coolers, 689
- High temperature superconductor applications (*see* Integration of cryocoolers with)
- HTS-110, Ltd. (New Zealand), 385
- HTS applications (*see* Integ. of cryocoolers with)
- Hybrid multistage coolers:  
 4K hybrid Brayton/J-T cooler, 35  
 Ball 10K hybrid Stirling/J-T cooler, 13  
 IXO 50 mK sorption/ADR stage, 537  
 JAXA 1–4 K coolers for satellite missions, 1  
 NGAS 6K MIRI J-T/PT, 9  
 SPICA/SFARI sub-Kelvin cryogenic chain, 699
- Hydrides (*see* Sorption cryocoolers)
- Hypres, Inc.:  
 cooler figures of merit, 645
- India Institute of Sciences (Bangalore):  
 drive electronics for linear comp, 675, 681  
 moving magnet linear compressor, 361
- India Institute of Technology (Bombay):  
 20K Stirling-type PT investigation, 309  
 30K 1-stage GM-type PT investigation, 77  
 flow straighteners for U-type PT, 211  
 phasor analysis of PT refrig., 299  
 standing wave thermoacoustic refrig., 335  
 thermoacoustic comp. for 300 Hz operation, 343
- Industrial Research, Ltd. (New Zealand):  
 50K- 25 W PT with diaphragm comp., 175  
 oil-free diaphragm compressor, 375, 385
- Inertance tubes (*see* Pulse tube theory and investigations)
- Institute of Sci. and Indus. Research (Osaka):  
 study of AMR using spherical GdN, 531
- Integration of cryocoolers with:  
 cryosurgical probes, 731  
 thermal heat switches (*see* Heat switch)  
 cryogen boil-off reduction system (*see* Liquefaction of gases)  
 flow loops (*see* Remote cryogenic loads)  
 liquefaction of gases (*see* Liquefaction of gases)  
 microsatellite applications, 709
- remote loads (*see* Remote cryogenic loads)  
 space instruments (*see* Space instruments)  
 thermal storage (*see* Thermal storage)  
 vibration sensitive applications (*see* Vibration)
- IRIS Technology:  
 boundary layer effects in miniature PT, 267  
 hydrodyn. parameters in oscillatory flow, 411  
 impact of regenerator structural flaws, 281  
 modular linear-drive electronics, 667
- IXO space mission, sorption ADR stage, 537
- JAXA (Japan Aerospace Exploration Agency):  
 1 to 4K coolers for satellite missions, 1
- J-T cryocoolers:  
 4K hybrid Brayton/J-T cooler, 35  
 analysis of multistage J-T microcoolers, 481  
 heat exchanger configuration effects, 455  
 mixed-gas J-T for cryosurgical probe, 731  
 progress in J-T microcooling at U. Twente, 463  
 Rafael miniature fast cooldown J-T, 473  
 Rafael open-cycle J-T with mixed gases, 489  
 thermoacoustic expansion valve for, 497
- Jet Propulsion Laboratory (NASA):  
 thermal switching cryogenic heat pipe, 557
- Joule-Thomson Cryocoolers (*see* J-T cryocoolers)
- Kanazawa Univ. (Japan)  
 1 to 4K coolers for satellite missions, 1  
 magnetic regen modeling, 523  
 study of AMR using spherical GdN, 531
- Korea Adv. Inst. of Science and Tech.:  
 pressure drop in slit-type HX, 201
- Korea Inst. of Machinery and Materials:  
 J-T heat exchanger configuration effects, 455
- Korea Univ., 455
- Kryoz Tech. (Netherlands), J-T microcoolers, 481
- Lalbbhai Dalpatbhai (L.D.) College of Engin (India):  
 thermoacoustic comp for 300 Hz operation, 343
- Liquefaction of gases:  
 cryogen boil-off reduction system, 601  
 recondensing cryostat for PAMELA, 715  
 supercritical hydrogen liquefaction cycle, 721
- Liquid nitrogen, as thermal storage material, 583
- Los Alamos Nat'l Lab:  
 why high-freq PT can be tipped, 183
- Magnetic refrigerators:  
 2K ADR for remote cooling, 515  
 ADR for Micro-X sounding rocket, 547  
 IXO 50mK sorption/ADR stage, 537  
 numerical modeling of AMR regenerator, 523  
 refrigerant materials for (*see* Refrigerants)  
 regenerator materials for (*see* Regenerators)  
 study of AMR using spherical GdN, 531
- Massachusetts Institute of Technology:  
 ADR for Micro-X sounding rocket, 547  
 supercritical hydrogen liquefaction cycle, 721
- Materials:  
 refrigerants (*see* Refrigerants)

- regenerator (*see* Regenerators)
- Matra Marconi coolers (*see* Astrium coolers)
- Micro-X sounding rocket cooler system, 547
- Microsatellite cooler applications, 709
- MIRI 6K hybrid PT/J-T cryocooler, 9
- MIT (*see* Massachusetts Institute of Technology)
- Miniature Thermoacoustic Expander (MTAE), 497
- Mixed refrigerants (*see* Refrigerants, *and* J-T cryocoolers)
- N-Science, Corp., cooler performance survey, 633
- NASA/ARC (Ames Research Center), 601
- NASA/GRC (Glenn Research Center), 601
- NASA/GSFC (*see* Goddard Space Flight Center)
- NASA/JPL (*see* Jet Propulsion Laboratory)
- Nat'l Inst. for Materials Science (Tsukuba, Japan):  
 effect of charge pressure on GM perf., 71  
 numerical modeling of AMR regenerator, 523  
 study of AMR using spherical GdN, 531
- Nat'l Inst. of Standards and Tech. (*see* NIST)
- NICMOS reverse-Brayton cooler, 35
- NIST:  
 ADR for Micro-X sounding rocket, 547  
 devel. of 4K Stirling-type PT cryocooler, 27  
 performance of 4 K He-3 regenerator, 405  
 PT coupling to room-temp phase-shifters, 237  
 PT flow nonuniformities vs geometry, 227
- Northrop Grumman (NGAS) —*previously* TRW:  
 6 K MIRI cooler development, 9  
 HEC cooler performance, 143  
 micro PT cooler performance, 97  
 PT cooler with remote cooling, 611  
 vibration of NGAS PT coolers, 617
- Oil-free compressor for GM cooler, 375
- Orientation, affect on performance:  
 convection in pulse tube coolers, 6, **183**
- Osaka Univ., AMR of spherical GdN, 531
- P-V and T-S diagrams for study of coolers, 437
- PAMELA, recondensing cryostat for, 715
- Perovskites (*see* Refrigerants)
- Phase change materials (*see* Thermal storage)
- Pithawala College of Engin. (India), 77
- Prognostic health management system, 655
- Propellant liquefaction and densification (*see* Liquefaction of gases)
- Pulse tube cryocoolers:  
 3-stage PT cooler approaching 4K, 19  
 4 K Cryomech cryocooler, 65  
 77 K-12.5 W PT operating at 100 Hz, 157  
 AIM Infrarot-Module PT coolers, 133  
 CEA 15 K PT cold fingers for space, 45  
 CFIC 30 W 50 K coaxial with tapered tube, 163  
 IR 50 K- 25 W PT with diaphragm comp, 175  
 NGAS 60 K HEC 1 and 2-stage PT perf., 143  
 NGAS micro PT cooler, 97  
 NIST 4K Stirling-type PT cryocooler, 27  
 performance survey for 1999 to 2009, 633  
 single-stage PT working below 30 K, 51
- SITP 60 K 1-stage coaxial PT coolers, 149
- SITP large capacity coaxial PT coolers, 167
- SITP miniature coaxial PT cooler, 103
- Sumitomo high-efficiency 4 K PT cooler, 57
- Technion miniature in-line PT, 87
- Pulse tube theory and investigations:  
 20 K Stirling-type PT cooler, 309  
 30 K 1-stage GM-type PT cooler, 77  
 35 K regenerator perf at high frequency, 429  
 axial temp mismatch in coaxial PT, 193  
 boundary layer effects in miniature PT, 267  
 coaxial PT with tapered tube, 163  
 comp. of TEC and Stirling-type coolers, 327  
 continuously variable inertance tubes, 275  
 coupling to room-temp phase-shifters, 237  
 flow and heat transfer processes in PT, 219  
 flow nonuniformities vs geometry, 227  
 flow straighteners, for U-type PT, 211  
 gravity effects on high-freq PT perf., 183  
 impact of regenerator structural flaws, 281  
 inertance tube and reservoir modeling, 249  
 P-V and T-S diagrams for study of, 437  
 phase characteristics of high-freq PT, 259  
 phasor analysis of PT refrig., 299  
 regenerator studies, generic (*see* Regenerators)  
 remote cooling via PT cooling loop, 591, 611  
 slit-type heat exchanger pressure drop, 201  
 Technion miniature in-line PT, 87  
 thermal comparison of two 2-stg PTs, 291  
 vibration of NGAS PT coolers, 617  
 why high-freq PT can be tipped, 183
- Quantum Design, Inc., He compressor, 371
- Rafael, Ltd.:  
 miniature fast cooldown J-T, 473  
 open-cycle J-T with mixed gases, 489
- RAL (Rutherford Appleton Lab):  
 Herschel sorption coolers, 689
- Rare earth compounds (*see* Regenerators)
- Raytheon Space Systems (*formerly* Hughes Aircraft):  
 modular linear-drive electronics, 667
- Recondensing cryostat development, 715
- Recuperative heat exchangers (*see* Heat exchangers)
- Refrigerants, AMR using spherical GdN, 531
- Regenerators:  
 35 K regenerator perf at high frequency, 429  
 axial temp mismatch in coaxial PT, 193  
 experiments with AMR of spherical GdN, 531  
 friction factor and Nusselt num from CFD, 397  
 heat transfer during transient flow, 419  
 hydrodynamic parameters in oscil. flow, 411  
 impact of regenerator structural flaws, 281  
 numerical modeling of AMR regenerator, 523  
 P-V and T-S diagrams for study of, 437  
 performance of 4 K He-3 regenerator, 405
- Re-Liquefaction of gases (*see* Liquefaction of gases)
- Remote cryogenic loads, cooling of via:  
 Atlas Scientific PT cooler with circulator, 591  
 NGAS PT cooler with remote cooling, 611

- Reverse-Brayton cryocoolers:  
 4K hybrid Brayton/J-T cooler, 35  
 advanced compressor for, 391  
 NICMOS operation on HST, 35
- Ricor, Ltd.:  
 compact linear split-Stirling cooler, 121  
 performance of 4 K He-3 regenerator, 405
- Rotary cooler, vibration suppression of, 623
- SAFARI sub-Kelvin cryogenic coolers, 699
- SANTOKU Corp. (Japan), AMR using GdN, 531
- Sardar Vallabhbhai (S.V.) Nat'l Inst. of Tech. (India):  
 30 K 1-stage GM-type PT investigation, 77  
 thermoacoustic comp for 300 Hz operation, 343
- Sest, Inc., prognostic health mgmt system, 655
- Shanghai Inst. of Tech. Physics / CAS:  
 60 K 1-stage coaxial PT coolers, 149  
 axial temp mismatch in coaxial PT, 193  
 large capacity coaxial PT coolers, 167  
 miniature coaxial PT cooler, 103  
 phase characteristics of high-freq PT, 259
- Siemens, Inc., parameters in oscillatory flow, 411
- Slit-type heat exchanger pressure drop, 201
- Sorption cryocoolers:  
 14.5 K hydrogen sorption cooler, 445  
 cryo adsorption vs pore size in carbons, 567  
 IXO 50 mK sorption/ADR stage, 537  
 sub-Kelvin sorption coolers on Herschel, 689
- Space cryocooler overviews:  
 DoD microsatellite missions, 709
- Space instrument missions:  
 Akari (Astro-F), 1  
 Herschel, sorption coolers, 689  
 IXO, sorption ADR stage, 537  
 MIRI (JWST), 6K cooler, 9  
 NICMOS, 35  
 SPICA/SAFARI, 699, 1
- SPICA/SAFARI space mission coolers, 699, 1
- STFC Daresbury Laboratory, 715
- Stirling cryocoolers:  
 insights into machine behavior, 317  
 performance survey from 1999 to 2009, 633  
 Ricor compact linear split-Stirling cooler, 121  
 Thales new generation miniature, 111  
 vibration suppression of rotary, 623
- Sub-Kelvin coolers:  
 ADR for Micro-X sounding rocket, 547  
 IXO 50 mK sorption/ADR stage, 537  
 sorption coolers on Herschel, 689  
 SPICA/SAFARI sub-Kelvin cooler chain, 699  
 Walther-Meissner Inst., dilution refrig., 509
- Sumitomo Heavy Industries:  
 1 to 4 K coolers for satellite missions, 1  
 effect of charge pressure on GM perf., 71  
 high efficiency 4 K PT cooler, 57
- Superconductor applications (*see* Integration of cryocoolers with)
- Switch, cryogenic thermal (*see* Heat switch)
- Technical Inst. of Physics and Chemistry (CAS):  
 77 K-12.5 W PT operating at 100 Hz, 157  
 single-stage PT working below 30 K, 51
- Technion - Israel Inst. of Tech., 87
- Thales Cryogenics:  
 new generation of miniature coolers, 111  
 sorption coolers on Herschel, 689
- Thermal storage:  
 LN2 energy storage units, 583  
 using triple point of hydrogen, 575
- Thermal switch (*see* Heat switch)
- Thermoacoustics:  
 expansion valve for recuperative systems, 497  
 standing wave thermoacoustic refrig., 335  
 thermoacoustic comp for 300 Hz operation, 343
- Thermoelectric coolers (TEC):  
 comp. of TEC and Stirling-type coolers, 327
- TRW coolers (*see* Northrop Grumman)
- TS-dot Engineering, Ltd. (New Zealand), 175
- Turbo Brayton coolers (*see* reverse Brayton coolers)
- Univ. of Canterbury (New Zealand):  
 50 K - 25 W PT with diaphragm comp, 175  
 insights into Stirling machine behavior, 317
- Univ. of New Mexico,  
 inertance tube and reservoir modeling, 249  
 perf. of TEC vs Stirling-type coolers, 327  
 thermal comparison of two 2-stg PTs, 291
- Univ. of Twente:  
 14.5 K hydrogen sorption cooler, 445  
 analysis of multistage J-T microcoolers, 481  
 progress in J-T microcooling, 463
- Univ. of Wisconsin:  
 ADR for Micro-X sounding rocket, 547  
 continuously variable inertance tubes, 275  
 friction factor and Nusselt num from CFD, 397  
 mixed-gas J-T for cryosurgical probe, 731
- Vibration:  
 rotary cooler vibration suppression, 623  
 vibration of NGAS PT coolers, 617
- Virginia Military Institute, PT flow analysis, 227
- Virtual AeroSurface Tech.:  
 hydrodyn. parameters in oscillatory flow, 411  
 impact of regenerator structural flaws, 281
- Walther-Meissner Inst., dilution refrig., 509
- Zero-boil-off cryogen storage (*see* Liquefaction of gases)
- Zhejiang Univ.:  
 3-stage PT cooler approaching 4 K, 19  
 35 K regenerator perf at high frequency, 429  
 clearance seal loss analysis using CFD, 353  
 continuously variable inertance tubes, 275