Centre for Advanced Studies in Cryogenics (CASC)

About

Many areas related to cryogenics engineering in mechanical, electrical, electronics, chemical, bio medical, bio technology, nano technology and medical engineering are still not fully explored.

Great scope exists in studying and developing systems, devices and products ingeniously.

Aimed also at developing strategic technologies and products to assist in the fields of space, defence and atomic energy.

Inter-departmental resources within NITC and external groups in the related areas are collaborated

Large number of GoI departments, industry and students in various streams benefit from academic research coupled with product oriented research.

There are off shoot of the themes and by products

As a result, product oriented design and development of devices, equipments, instruments, technologies for various engineering and science streams in space, defence, atomic energy and industries is expected.

Thus it helps developing a strong academics base and open venue for graduants in academics, research and industry along with deliverable products.

Collaborating Institutes & departments in India

IISc Bangalore
IIT Bombay
IIT KGP
IIT Madras

NIT Calicut

1. CASC
2. EEE
3. SMSE(SNST)
4. CHED
5. Bio technology and Bio medical

Other collaborators in India

1. Center for cryogenic technology, IISc Bangalore
2. IUAC Indore
3. Cryogenic engines, cryo stage, Turbo-pumps, cryo instrumentation- Liquid propulsion system centre- ISRO
4. Satellite cryo systems, space simulation, Thermal control- ISRO Satellite centre (ISAC) Bangalore
5. Satellite application centre (SAC)
6. Space Physics Lab, VSSC, ISRO
7. Cryo lab, Super conductivity & magnets- Nuclear Science Centre –
8. Defence Science centre and SSPL, DRDO
9. Institute for Plasma research, BRFST

Abroad Collaborators/ advisors

1) Prof. John G. Brisson, MIT Cryogenics laboratory, Massachusetts Institute of Technology

2) Prof. Srinivas Vanapalli, Cryogenics laboratory, University of Twente, The Netherlands

Main Themes

1.Cryogenic systems and devices for space, defence and industry applications (CASC, MED)

2. High temperature superconductivity and Cryo electro-magnetics

3. Cryo Nano technology: Nano additives, refrigerants HE, MMR and MEMS

4. Cryo adsorbers, refrigerants, gas mixtures and anti-wear polymer surfaces

5. Cryo medical instruments/probes, cryo preservation and food processing

1

Cryogenic devices, instruments, coolers (working on various cycles such as: Stirling, IR detector coolers, PTC, JT, Brayton, its combinations for staging, GM, vortex, magnetic, anti-Stokes optical, TEC) for space, defence and atomic energy programmes, Non CFC Stirling cycle operated coolers, deep freezers, free piston engines and CHP for environment friendly applications, magnetic refrigerators, anti-Stokes optical coolers and sorption, dilution technology for critical applications. Cooled sensors and detection/imaging, Cryogenic, semi cryogenic and tri-propellant rocketry systems modelling and sub-scaled prototyping. Cryo material characterization and testing. Separation Processes, Natural gas processing, Carbon dioxide capture and sequestration. Compact cryogenic storage and transfer systems. Vortex tube air separation technology for fighter aircrafts. Super insulation and compact Dewar for space, Compact space simulation chamber.

2

Electro-magnetic circuits Applied superconductivity with high temperature superconductivity (HTS), HTS magnetic bearings, gyroscopes, micro motors. Superconducting power devices: generator/motor, HTS current leads, transformer/fault current limiter, Superconducting power system superconducting materials: Properties and characterization, Quench propagation and cryogenic stability, AC losses.

3

Nano additives, refrigerants and gases, HE/regen, MMR and MEMS, Nano additives in refrigerants and Formation of Nano deposits on mating surfaces for long life non lubricated surfaces

4

Cryo adsorbers, gas mixtures, anti-wear filled polymers, cooled gas hydrates. Mixed inert gases for cryocoolers, advent of new generation refrigerants, Photo-chemical processes, surface depositing and hardening technologies.

5

Cryo assisted medical probes, cryo food processing and bio matter preservation, preservation of valuables

Important Equipments

Table-top LN2 Generator with Transfer Station and Dewar

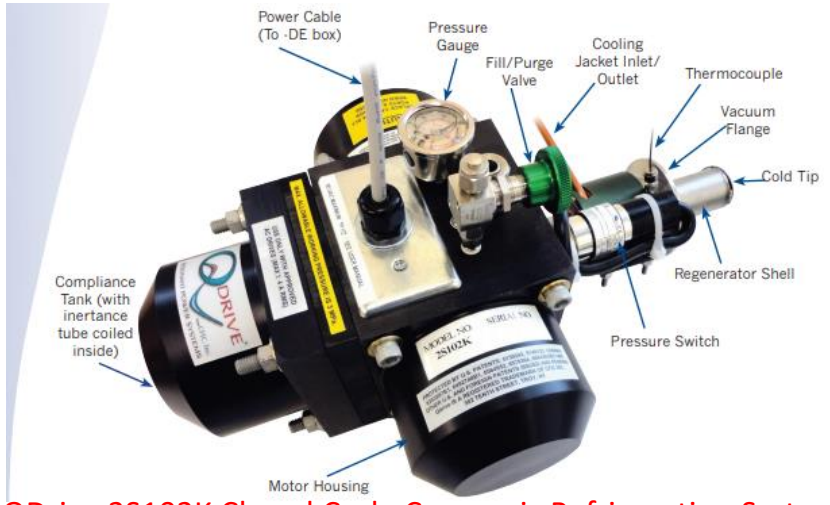
Cooling using Kleemenko cycle, liquefaction by Joule-Thomson effect
Yield of up to 6 litre/week under controlled conditions
Self-cleaning cycle if production rate or efficiency decrease
Warning if humidity / temperature exceed allowable limits

Make and model : MMR Technologies USA, Elan2 Digital LN2 generator

Components:
Air compressor
Generator
Transfer station
20L Collection Dewar and Scale

Some Equipments in CASC

Digital Power Analyser WT500



QDrive 2S102K Closed Cycle Cryogenic Refrigeration System

Ricor K508 Stirling Rotary Cooler

Ricor K527 Linear Cooler

Equipment	Make	Model	Description
Digital power Analyser WT500	Yokoqawa Japan	WT500	Capable of analysing DC and AC inputs VAR, VA and W, frequency etc.
Closed cycle PTC cryogenic refrigeration system	Qdrive, USA, taken over by Chart industries USA	2S102K water cooled	Closed cycle high capacity PT cooler
K508 assembly Stirling cooling engine	Ricor cryogenic and vacuum systems, Israel	K508	High tech rotary cooler producing low temperatures with a brushless DC motor
K 562 Cooler assembly	Ricor cryogenic and vacuum systems, Israel	K 562	Compact cooler capable of producing cryogenic temperatures
K 527 Linear cooler system	Ricor cryogenic and vacuum systems, Israel	K527	New generation linear cooler for new generation sensors

About the Founder & Co-ordinator

Specialized in Cryogenics engineering. 27 years of post Ph.D experience with reputed national and international institutes and laboratories: Space R&D, Defence R&D, Universities. Core member in the design and development of indigenous cryogenic rocket engines and cryogenic upper stage engines for GSLV mission. Chief formulator and designer for 2D and 3D heat transfer packages for various rocket engine thrust chambers and engines. Core member in the hydrogen technology development and hydrogen inducted IC engine (Uni. of Quebec). Trained by hydrogen research institute, Uni of Victoria, Uni of Toronto, Ames lab, Astronautics corporation of America, Stennis space centre. Designed and developed various cryogenic coolers for infra-red sensor module for onboard space craft detector cooling applications and main battle tanks. Taken up consultancies and sponsored projects worth 2+ Crore. Developed centre for advanced studies in cryogenics (CASC) for developing technologies in important and strategic technologies. Close collaboration with industries, R&D organizations and other academic institutes. Independently and jointly taken up sponsored research projects. New joint projects are being taken up with ISRO, BRNS, BRFST, IPR, ARDB, DRDO and Nuclear Science Centre. Strong Academy Industry collaboration. Gained valuable experience working with internationally renowned personalities in India and abroad, completed various projects and consultancies (Including IISc). Great levels of appreciation by eminent personalities for developing useful products and systems for sensitive departments at CASC surpassing even IITs. Recipient of national award in the field of cryogenics.