



SNS COLLEGE OF TECHNOLOGY

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DEPARTMENT OF AEROSPACE ENGINEERING

Faculty Name : **Dr.A.Arun Negemiya,** Academic Year : **2024-2025 (Odd)**
AP/ Aero
Year & Branch : **III AEROSPACE** Semester : **V**
Course : **19AST301 - Space Propulsion**

UNIT IV - CRYOGENIC EQUIPMENT

Cryogenic evaluation refers to the process of assessing materials, components, or systems at extremely low temperatures, typically below -150°C (-238°F). This evaluation is crucial in various fields, including aerospace, materials science, and cryogenics, as many materials behave differently under such conditions.

Key Aspects of Cryogenic Evaluation:

1. Material Properties:

- **Mechanical Properties:** Evaluating tensile strength, ductility, toughness, and fatigue resistance at cryogenic temperatures.
- **Thermal Properties:** Assessing thermal conductivity, heat capacity, and thermal expansion.

2. Applications:

- **Aerospace:** Testing materials for rocket components, such as fuel tanks and engines, where they may encounter cryogenic propellants like liquid oxygen or liquid hydrogen.
- **Superconductors:** Evaluating materials used in superconducting applications, which often operate at cryogenic temperatures.
- **Storage and Transport:** Assessing the performance of containers and pipelines designed for transporting cryogenic liquids.

3. Testing Methods:

- **Mechanical Testing:** Includes tensile tests, impact tests, and fatigue tests at cryogenic temperatures.
- **Thermal Cycling:** Subjecting materials to temperature fluctuations to assess their behavior under thermal stress.
- **Non-destructive Testing (NDT):** Techniques like ultrasonic testing or X-ray inspection to evaluate the integrity of materials without causing damage.

4. **Standards and Protocols:**

- Various standards exist (e.g., ASTM, ISO) that guide the cryogenic evaluation of materials, ensuring consistency and reliability in results.

5. **Challenges:**

- **Brittleness:** Some materials become brittle at cryogenic temperatures, leading to potential failure.
- **Measurement Issues:** Instruments and sensors may have limitations at low temperatures, affecting accuracy.

Cryogenic evaluation is essential for ensuring the safety and performance of materials and systems used in low-temperature environments