SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited by NAAC-UGC with 'A++' Grade (Cycle III)
Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)
COIMBATORE-641 035, TAMIL NADU

TOPIC: Production of Low Temperature

Introduction

Refrigeration is defined as "the process of cooling of bodies or fluids to temperatures lower than those available in the surroundings at a particular time and place". It should be kept in mind that refrigeration is not same as "cooling", even though both the terms imply a decrease in temperature. In general, cooling is a heat transfer process down a temperature gradient, it can be a natural, spontaneous process or an artificial process. However, refrigeration is not a spontaneous process, as it requires expenditure of energy (or availability). Thus cooling of a hot cup of coffee is a spontaneous cooling process (not a refrigeration process), while converting a glass of water from room temperature to say, a block of ice, is a refrigeration process (non-spontaneous). "All refrigeration processes involve cooling, but all cooling processes need not involve refrigeration". The temperature of the system which is being refrigerated should be lower than the surrounding temperature that is the major point to be noted here.

Definition of a cold surface. Often, this is a real solid cold surface, such as a cold finger in a cryo cooler or an evaporator in a household refrigerator. But some refrigerators produce a cold liquid cryogen (liquid helium, liquid neon, or liquid nitrogen), which – while flowing to/through the cooling object (e.g. a superconducting magnet) – evaporates and the vapour is then returned to the refrigerator. In this case, the cryogen liquid surface can be considered as the cold surface. Refrigerator/liquefier. In low-temperature science, we often use another device called a 'liquefier'. A liquefier produces cold liquid that is then drawn off. The

thermodynamics is the same for both the refrigerator and the liquefier, but it is useful to start with refrigerator thermodynamics, because it is a bit simpler. Cooling capacity. Some cooling objects do not produce any heat of their own: they just need to be cooled to a defined temperature – and that is all. But the most cooling objects (magnets, sensors, current leads) generate heat continuously during operation, and therefore need permanent cooling. The ‘heat’ in this case is a permanent heat flow from the cooling object to the refrigerator. This heat flow corresponds to the ‘cooling power’ or ‘cooling capacity’ of the given refrigerator.