

UNENE Graduate Course
Reactor Thermal-Hydraulics Design and
Analysis

McMaster University

Whitby

March 11-12, March 25-26,
April 8-9, April 22-23, 2006

Entropy

Dr. Nik Popov

Entropy

- Entropy is a quantitative measure of microscopic (molecular) disorder of a system
- Entropy is a state parameter and can be expressed in terms of other parameters
 - $S = S(P, T)$ for subcooled or superheated conditions
 - $S = S(P)$ or $S(T)$ for saturated conditions
 - $S_m = x S_f + (1-x) S_g$, $S_m = S_f + x S_{fg}$
- Entropy generated through a process in an isolated system can not be negative
- Entropy is a non-conserved property (always increases in isolated systems, such the universe)
- Entropy increase in engineering processes is a measure of irreversibilities in these processes (measure of non-efficiency of engineering systems)

Entropy

- What is entropy? Not possible to provide a complete answer
- If understood as a measure of molecular disorder, entropy increases from solid to liquid, and to gas phase
- Energy can be conserved, but the “quality of energy” can not be, as it decreases with entropy increase (“organized” and “disorganized” types of energy)
- Entropy change is closely associated with heat transfer. In a heat transfer from a hotter to a colder subsystem, the hotter subsystem exhibits a decrease of entropy, while the cold system an increase. However, the increase in the cold subsystem is higher, thus making the entropy change of the combined system positive

Entropy

- The entropy of a system at temperature of absolute zero is also zero (3rd Law of Thermodynamics)
- Things in nature change in the direction of reaching equilibrium. Entropy reaches a maximum value when an equilibrium is reached
- Efficient (organized) people lead low-entropy life
- Well organized library is a low-entropy library
- Friction in the work place will fellow workers is bound to generate entropy, and adversely affects performance

Questions?