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Reversible and Irreversible Processes

• Reversible Processes

The following processes are frequently idealized as reversible processes.

- Restrained compression and expansion
- Frictionless motion
- Elastic extension of a solid
- Electric circuits of zero resistance
- Restrained discharge of a battery
- Polarization and magnetization effects

A process is said to be irreversible when the process is such that the system and its surroundings cannot be returned to their initial states. The irreversibilities arise from two sources:

1. Inherent dissipative effects that arise from the nature of the substance itself. These effects include friction of any type, electrical resistance, magnetic hysteresis and inelasticity.
2. Absence of mechanical, thermal, or chemical equilibrium during a process, i.e., a nonquasistatic process.

Irreversibilities include:

- Electrical resistance
- Inelastic deformation
- Internal damping of a vibrating system
- Solid-solid friction
- Hysteresis effects
- Viscous flow of fluids
- Unrestrained expansion of a fluid
- Fluid flow through valves and porous plugs (throttling)
- Mixing of dissimilar gases
- Osmosis
- Dissolution of one phase into another phase
- Mixing of the same two fluids initially at different pressures and temperatures

The above list of irreversibilities are part of one's experience. These processes cover a wide range of physical and chemical effects.