Adiabatic Processes

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Introduction to Adiabatic Processes

What are Adiabatic Processes?

In adiabatic processes, no heat exchange occurs between a system and its environment. This happens when the system is either thermally insulated or very rapid. For example, there may be no chemical processes taking place in the fluid and no heat transfer from the environment. The term "adiabatic" describes things that are impermeable to heat transfer; for example, an adiabatic boundary is a boundary that is impermeable to heat transfer.

Adiabatic Heating and Cooling

Adiabatic heating and cooling are processes that commonly occur due to changes in thepressure of agas, and can be quantified using theideal gas law. Adiabatic heating and cooling is common in convective atmospheric currents. In adiabatic heating and cooling, there is no net transfer of mass or thermal exchange between the systems.

Adiabatic heating happens when work done on a gas by its surroundings, e.g. apiston, causes the pressure of a gas to increase. Diesel engines rely on adiabatic heating during their compression stroke to elevate the temperature sufficiently to ignite the fuel.

Adiabatic cooling occurs when the pressure of a substance falls as it does work on its surroundings. Adiabatic cooling does not have to involve a fluid. One technique used to reach very low temperatures (thousandths and even millionths of a degree above absolute zero) isadiabatic demagnetisation, where the change in themagnetic field on a magnetic material is used to provide adiabatic cooling.

Example of Adiabatic Process

An example of an adiabatic process is the vertical flow of air in the atmosphere; air expands and cools as it rises, and contracts and grows warmer as it descends. Another example is when an interstellar gas cloud expands or contracts.

Adiabatic changes are usually accompanied by changes in temperature. In most situations, truly adiabatic changes must take place in short time intervals so that the heat content of the system remains unchanged. Otherwise, the system must be perfectly insulated (a practical impossibility). The generation of heat when a gas is rapidly compressed, as in a piston, is approximately adiabatic.

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Reference links:

- http://www.en.wikipedia.org/wiki/ideal gas
- http://www.wordiq.com/definition/Reversible_process
- http://en.wikipedia.org/wiki/Magnetic_field
- http://www.daviddarling.info/encyclopedia/T/temperature.html

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