Chapter 26

ENTHALPY OF COMBUSTION

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ABSTRACT

Results for enthalpy of combustion are presented for major organic chemicals. The results are displayed in an easy-to-use table that is especially applicable for rapid engineering usage. The organic chemicals encompass hydrocarbon, oxygen, nitrogen, halogen, silicon, sulfur and other type compounds.

ENTHALPY OF COMBUSTION

The results for enthalpy of combustion are presented in Table 26-1 for organic chemicals. The enthalpy of combustion is the net increase in heat content when a substance in its standard state at ambient conditions (77 F, 1 atm) undergoes complete oxidation.

The tabulated values are the negative of the enthalpy of combustion. A positive value as shown means that heat is released in the combustion. A negative value means that heat is required for the combustion. For substances in the table, the products of combustion are CO2 (gas), H2O (gas), F2 (gas), Cl2 (gas), Br2 (gas), I2 (gas), N2 (gas), SO2 (gas), H3PO4 (solid) and SiO2 (crystobalite).

In the data collection, a literature search was conducted to identify data source publications (1-94) for the table. The publications were screened and copies of appropriate data were made. These data were then keyed into the computer to provide a database for use in preparing the table.

EXAMPLES

The tabulated values maybe used in engineering applications involving combustion. Examples are given below.

Example 1 Combustion of propane (C3H8, 50 kg/hr) occurs at ambient conditions (77 F, 1 atm). Estimate the quantity of heat released in the combustion.

Substitution of the tabulated value for propane into the equation below provides the quantity of heat released:

$$\Delta H = (-\Delta H_{combustion})(mass) = (46{,}333 \text{ kjoule/kg})(50 \text{ kg/hr})$$

$$\Delta H = 2.32 \text{ million kjoule/hr}$$

Example 2 Combustion of n-hexane (C6H14, 150 lb/hr) occurs at ambient conditions (77 F, 1 atm). Estimate the quantity of heat released in the combustion.

Substitution of the tabulated value for n-hexane into the equation below provides the quantity of heat released:

$$\Delta H = (-\Delta H_{combustion})(mass) = (19{,}236.4 \text{ BTU/lb})(150 \text{ lb/hr})$$

$$\Delta H = 2.89 \text{ million BTU/hr}$$

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