The semiautomatic combustion calorimeter with an isothermal air bath and a static bomb

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A semiautomatic static-bomb combustion semimicrocalorimeter with an isothermal air bath aimed for the determination of the combustion energies for compounds of the general formula $C_aH_bO_cN_d$ has been designed and made. Its basic technical characteristics are:

overall dimensions	50×250×350 mm
bath temperature	20 – 40°C
accuracy of the bath temperature maintaining	±0.02°C
maximum power consumption during a warming-up period	40 W
temperature-sensing device	Pt500
resolution upon a temperature-rise measurement	better than 10^{-4} K
reproducibility of the energy equivalent in a calibration series with the temperature rise amounting to 0.8 K	±5 J·K^{-1}

A stand-alone unit built on the basis of an AT8958253 microprocessor controls the calorimeter. PC software running under Windows 98, 2000, XP was developed for the experimental data processing according to the recommended calculation procedures [1] with additional introduction of corrections for incomplete burning of a sample. At present, a control unit on the basis of an LPC2138 microprocessor (ARM7 type) that allows performing all the calculations in an independent mode without PC has been made and is being tested.

The calibration of the calorimeter was carried out using reference benzoic acid (VNIIM, St.Petersburg, K-2 grade). With V_{bomb} = 95.6 cm^3 and t_{bath} = 28.5°C, the energy equivalent was ε(calor) = (9826.0 ± 3.1) J·K^{-1}. The calorimeter design allows changing the volume of the calorimetric vessel within (1 to 2) dm^3 and the bomb volume in the range from (50 to 250) cm^3. Hence, a possible value of ε(calor) can fall in the range (5000 to 10000) J·K^{-1}.

The standard combustion energies and enthalpies for 2-adamantanone, 1,1'-biadamantane, 1-aminoadamantane were determined.

[1] W.N. Hubbard, D.W. Scott, G. Waddington. In: Experimental thermochemistry. Measurement of heats of reaction. F.D. Rossini (Ed.). Interscience Publishers Inc. New York. 1956. Pp. 75–128.