

Molar Standard Enthalpies of Combustion and Formation of the Fullerene C84

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Despite the improvements in the methods of isolation and purification of higher fullerenes by chromatographic techniques, these allotropes of the carbon are very expensive and commercially available in not more than a few milligrams. In the same way, due to the large quantity of sample required to carry out the measurement of the energy of combustion of a substance by conventional combustion calorimetry, the study of the fullerenes utilizing this technique, has been restricted to the fullerenes C60 and C70, being impossible to apply to larger fullerenes. These facts imply that a thermochemical study involving the measurement of the energy of combustion of fullerenes as the C84 would not be possible without the development of micro-combustion methods.

In this work we report the first measurement of the energy of combustion of the fullerene C84 using a micro-combustion technique, which utilize a set of combustion micro-bombs associated with a Calvet calorimeter and samples of 2 mg or less per experiment. The accuracy of the device has been already verified in our laboratory, by applying it to the measurement of the energy of combustion of fullerenes C60 and C70. Besides, to verify the total oxidation of the sample of fullerene, we designed and developed a system of adsorption of carbon dioxide, which allowed us to measure the percent of carbon dioxide recovered from the combustion of the sample.

Simultaneous application of both techniques throughout a set of measurements, has made it possible to measure the energy of combustion and derive the enthalpy of combustion of fullerene C84, with a precision comparable or better than those reported by other authors for the study of the C60 and the C70, where samples of 10 mg or more of fullerene were utilized per experiment.