The $\alpha(v)$ curve *per se* provides a means of estimating the validity of the $\alpha(v)$ approximation. In the limit of low pressures, α should emerge smoothly into the van der Waals b. Hence, as a covolume, α should be about four times greater than the actual volume v_m of the molecules. Hence one should have for the internal energy increase due to the applied pressure p,

$$E_i = -\tfrac{1}{4}\int_0^p p\,\mathrm{d}\alpha \cong -\frac{nRT}{4}\int_0^v \mathrm{d}\alpha/(v-\alpha).$$

The integral has as an upper limit for CHNO explosives a value of about 2·5 giving an upper limit value for E_i of about 200 cal/g. But Q (the heat of explosion) plus the Hugoniot energy $\frac{1}{2}p(v_1 - v_2)$ is in this upper limit case about 1800 cal g^{-1} giving $E_i/(Q+\frac{1}{2}p(v_1-v))=$ 0·1 to 0·15.

One may also estimate E_i directly by the methods used here for thermal expansion and compressibility of solids. Thus

$$E_i = \Delta T = \int_0^p p\,\mathrm{d}v = \int_0^p v_m p\left(\frac{1}{v_m}\,\frac{\mathrm{d}v_m}{\mathrm{d}p}\right)\mathrm{d}p < v_m \beta p^2/2.$$

The theory for molecules of the type considered here also gives $\beta_0 \leqslant 10^{-6}$ atm^{-1}. Since $\bar{v}_m$ should have an upper limit of 0·5 cm^3 g^{-1}, one thus obtains $E_i \sim 200$ cal g^{-1} in agreement with the above estimate.

According to these estimates therefore, while the $\alpha(v)$ equation of state gives an upper limit for T_2, the actual value should be no more than 10-15 % (or about 500° K) less. This is, however, in sharp contrast with the approximately 3000° K lower values for T_2 computed for PETN at $\rho_1 = 1{\cdot}7$ g cm^{-1} by Cottrell and Paterson.[19]

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