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PRESSURE CORRECTIONS IN MEASUREMENTS OF ENERGY ACCOMMODATION COEFFICIENTS*

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Abstract — Measurements of the Knudsen accommodation coefficient for energy (α_{44}) with the hot-wire instrument require a correction for the effect of intermolecular collisions in the gas. Traditional methods for this correction are discussed, and a new one is proposed. In the low-pressure regime, the uncertainty of the evaluated α_{44} can be reduced to a few percent or less.

NOMENCLATURE

$A(v)$,	Chapman–Enskog function for heat conduction;
$f(\mathbf{r}, \mathbf{v})$,	phase space density;
$f^{\pm}$,	$= f(\mathbf{r}_0, \pm \mathbf{v})$, $v_r > 0$, outgoing and ingoing f at wire surface;
$h(\mathbf{r}, \mathbf{v})$,	correction term in $f(\mathbf{r}, \mathbf{v})$;
j,	$= n_0\bar{v}/4$, equilibrium molecular flux hitting and leaving the wire surface;
k,	Boltzmann constant;
$K(\mathbf{v} \to \mathbf{v}')$,	scattering kernel in linearized Boltzmann equation;
$\hat{K}$,	intermolecular scattering operator;
l,	$= 2\lambda/15kj$, mean free path;
L,	unknown length of order l;
m,	mass of molecule;
$M(\mathbf{v})$,	$= (m/2\pi kT_0)^{3/2} \exp(-mv^2/2kT_0)$, normalized Maxwellian at temperature T_0;
n_0,	$= p/kT_0$, number density of gas at $T = T_0$;
p,	pressure;
$P(\mathbf{v} \to \mathbf{v}')$,	surface scattering kernel;
$\hat{P}$,	surface scattering operator;
q,	heat flux from wire to gas;
Q_i,	dynamic quantities;
Q_4,	$= mv^2/2kT_0 - 2$, reduced energy;
r,	radial co-ordinate;
r_0, r_1,	radii of wire and of outer wall;
$\mathbf{r}$,	position vector;
R,	correction to $1/\alpha_{44}$;
$T(\mathbf{r})$,	true or extrapolated gas temperature;
T_0, T_1,	temperatures of wire surface and of outer wall;
$\mathbf{v}$,	velocity vector;
v_r, v_φ,	radial and azimuthal velocity components at wire surface;
$\bar{v}$,	$= (8kT_0/\pi m)^{1/2}$, mean molecular speed at T_0.

Greek symbols

α_{ij},	Knudsen accommodation coefficients of wire surface;
γ,	$= 0.577\ldots$, Euler's constant;
ΔT,	$= T_0 - T_1$, temperature difference between wire and outer wall;
ε,	small parameter;
ζ,	temperature-jump coefficient at wire surface;
λ,	heat conductivity;
ν,	scattering rate;
ϕ_i,	flux of Q_i.

Subscripts

1, 2, 3, 4, λ,	labels of Q_i;
0, 1,	wire surface and outer wall, respectively.

Superscripts

+, −,	referring to outgoing and ingoing distributions and fluxes at wire surface;
*,	referring to outgoing flux in case of perfect accommodation.

Abbreviations

AC,	accommodation coefficient;
LTE,	local thermodynamic equilibrium.

1. INTRODUCTION

THE KNUDSEN accommodation coefficients (ACs) [1, 2] refer to exchange rates of dynamic quantities Q_i between a gas and a surface under specific near-equilibrium conditions. That is, we assume the distribution incident upon the surface under consideration to be of the form

$$f^- = f_j = n_0 M(\mathbf{v})[1 + \varepsilon Q_j(\mathbf{v})], \quad \varepsilon \ll 1. \qquad (1)$$

The notation refers to a monatomic gas, to which we

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shall restrict ourselves. The AC for quantity Q_i under disturbance of type j is then defined by the flux ratio,

$$\alpha_{ij} = \left.\frac{\phi_i^- - \phi_i^+}{\phi_i^- - \phi_i^*}\right|_{f^- = f_j}$$

The dynamic quantities of primary importance are the components of momentum and the energy of the molecule. For the sake of convenient calculation each of these quantities $(Q_1, \ldots, Q_4)$ is made dimensionless, and redefined so that the average over a Maxwellian flux in equilibrium with the surface vanishes,

$$\langle Q_j \rangle = \frac{4}{\bar{v}} \int_{v_r > 0} d^3 v \, v_r M(\mathbf{v}) Q_j(\mathbf{v}) = 0. \qquad (2)$$

This convention allows a compact expression for the ACs in terms of the surface-scattering operator,

$$\alpha_{ij} = \frac{\langle Q_i (1 - \hat{P}) Q_j \rangle}{\langle Q_i Q_j \rangle} = \alpha_{ji}, \qquad (3)$$

$$\hat{P} Q_j(\mathbf{v}) = \int_{v_r > 0} d^3 v' P(-\mathbf{v} \to \mathbf{v}') Q_j(\mathbf{v}').$$

Subject of the subsequent discussion is the AC for energy (α_{44}), which twice refers to

$$Q_4(\mathbf{v}) = mv^2/2kT_0 - 2.$$

The quoted review paper [2] should be consulted for further details regarding the above definitions and formulae.

As explained in the monograph by Goodman and Wachman [1] and in the literature cited therein, the standard tool for measuring α_{44} is the hot-wire instrument. It consists of a thin heated wire inside a coaxial tube, with the wire also serving as a resistance thermometer. Under free-molecular conditions, for small $\Delta T/T_0$ and large r_1/r_0, and after radiative and end losses have been subtracted, the energy AC for the wire surface is expressed in terms of measured quantities as follows,

$$\alpha_{44} = q/2jk\Delta T.$$

Ideal conditions are never attained in practice, and one therefore has to extrapolate to $\Delta T \to 0$. Furthermore, extrapolation to the free-molecular regime, or, alternatively, an analysis accounting for intermolecular collisions must be carried out. In either case we may speak of a pressure correction. It represents the most difficult part in the evaluation of measurements, and the one most likely to introduce errors.

Three distinct regimes characterized by the relative magnitude of the mean free path are of particular interest:

free-molecular: $r_1 \ll l$,

low pressure: $r_0 \ll l \ll r_1$,

high pressure: $l \ll r_0$.

It turns out that in the free-molecular regime, for convenient size of the apparatus and at not too low temperatures, radiative energy transfer is dominant, so that heat conduction is difficult to measure. This is why, in general, higher gas densities must be chosen, so that pressure corrections become inevitable. The traditional methods for doing this will be discussed first (Section 2), and then a refined correction proposed on the basis of known results from kinetic theory (Section 3). We assume that all other corrections have already been taken care of, and in particular that ΔT is sufficiently small to be negligible for higher-order effects. Further restrictions will be that $r_0/r_1 \ll 1$ and $l/r_1 \ll 1$, so that any terms of such orders can be neglected. The free-molecular regime is thereby excluded from subsequent discussion.

2. TRADITIONAL CORRECTION METHODS

Evaluation of measurements in the high-pressure regime usually proceeds either by the mean-free-path (MFP) or temperature-jump (TJ) methods [1]. The first also applies to low pressures. In both cases we rely upon local thermodynamic equilibrium (LTE) to hold within the gas, except for the transition layers close to the wire and the outer wall. The thickness of these layers is of the order of a mean free path.

In the MFP method it is assumed that the distribution incident upon both surfaces is Maxwellian, however with such temperatures as are attributed to the LTE regions at $r = r_0 + L_0$ and $r = r_1 - L_1$, respectively. The somewhat uncertain distances $L_{0,1}$ are of the order of a mean free path. It is convenient to extract from the evaluated heat flux an expression for the reciprocal AC,

$$\frac{1}{\alpha_{44}} = \frac{2kj\Delta T}{q} - \frac{4}{15}\frac{r_0}{l} \ln \frac{r_1 - L_1}{r_0 + L_0}. \qquad (4)$$

A term of the order r_0/r_1 has been neglected here.

In the TJ method, the logarithmic temperature profile is extrapolated to the boundaries, and the differences with respect to surface temperatures expressed in terms of extrapolated gradients. We only need the jump at the wire surface,

$$T(r_0) - T_0 = \zeta T'(r_0), \qquad (5)$$

which leads to

$$\Delta T = \frac{q r_0}{\lambda} \left[\ln \frac{r_1}{r_0} + \frac{\zeta}{r_0} \right]. \qquad (6)$$

A term $\zeta_1/r_1 \sim l/r_1$ has been neglected in the brackets. Equation (6) only becomes useful if a reliable expression for the jump coefficient ζ in terms of accommodation coefficients and surface curvature is available.

For very high gas densities even the wire surface can be considered as flat. A rough value for ζ is then obtained by Maxwell's method, which consists in replacing the incident molecular distribution by the extrapolated LTE distribution [3]. The LTE distribution may be further approximated by taking the Chapman–Enskog term proportional to

$$Q_\lambda(v) = \left(\frac{m}{2kT_0}\right)^{1/2} v_r \left(\frac{mv^2}{2kT_0} - \frac{5}{2}\right),$$

which corresponds to the first Chapman–Cowling approximation [4] and happens to be exact for the BGK model [5]. The resulting expression can be written in the form

$$\zeta = \frac{15}{4} l \left(\frac{1}{\alpha_{44}} - R\right). \qquad (7)$$

The correction term

$$R = \alpha_{4\lambda}/2\alpha_{44}, \qquad (8)$$

which corresponds to Welander's $\frac{1}{2}k$ [6], unfortunately contains a second-order accommodation coefficient $\alpha_{4\lambda}$, defined in the way of equation (3) by aid of Q_λ. The value (7), with expression (8) substituted, is too small by about 10%, as may be inferred from more accurate variational results [7, 8]. Hence it presumably does not matter much if $\alpha_{4\lambda}$ is set equal to α_{44}, as is often tacitly done. That is, the TJ-approximation used for high pressures is simply $R = \frac{1}{2}$.

A suitable expression for α_{44}^{-1} is obtained by substituting equation (7) into (6),

$$\frac{1}{\alpha_{44}} = \frac{2jk\Delta T}{q} - \frac{4}{15}\frac{r_0}{l}\ln\frac{r_1}{r_0} + R. \qquad (9)$$

It will be convenient to keep equation (7) as a definition for R, so that any formula for evaluating α_{44} can be cast into the form (9). Thereby the task is reduced to the calculation of the correction term R. Evidently this term depends upon various accommodation coefficients for the wire surface. As soon as the finite curvature of the surface must be taken into account, a dependence upon the ratio r_0/l also shows up, so that $R = R(\alpha_{ij}, r_0/l)$.

Little information about R can be obtained from the MFP result (4), except that $R \approx \frac{4}{15} L_0/l = O(1)$ for the high-pressure regime and

$$R \approx \frac{4}{15}\frac{r_0}{l}\ln\frac{L_0}{r_0} = \frac{4}{15}\frac{r_0}{l}\left[\ln\frac{l}{r_0} + O(1)\right]. \qquad (10)$$

for low pressures. Incidentally, Hurlbut's evaluation on the basis of the moments method of Lees and Liu [9] leads to $R = 0$, which is correct only in the limit of $r_0/l \to 0$, according to equation (10).

3. IMPROVED CORRECTION

Except for very small values of α_{44}, none of the above correction methods is fully satisfactory, because of the uncertainty involved. Especially for the low-pressure regime, which is often favoured by experimentalists, there definitely is a need for a more reliable method. Known solutions of the appropriate boundary-value problem for the Boltzmann equation [6, 10–12] can be used for this purpose. We are going to choose a (slightly modified) generalization of Maxwell's method due to Cercignani and Tironi [10, 13]. While this is not the most accurate method available, it does offer the desired degree of expediency and flexibility. Writing the distribution function as

$$f(\mathbf{r}, \mathbf{v}) = n_0 M(\mathbf{v})[1 + h(\mathbf{r}, \mathbf{v})],$$

we have the following form of the linearized Boltzmann equation,

$$\mathbf{v}\cdot\nabla h(\mathbf{r}, \mathbf{v}) + \nu(v) h(\mathbf{r}, \mathbf{v}) = \int \mathrm{d}^3v' K(\mathbf{v} \to \mathbf{v}') h(\mathbf{r}, \mathbf{v}') = \hat{K} h(\mathbf{r}, \mathbf{v}). \qquad (11)$$

Important general properties of the scattering operator are [5]:

$$M(\mathbf{v}) K(\mathbf{v} \to \mathbf{v}') = M(\mathbf{v}') K(\mathbf{v}' \to \mathbf{v}), \qquad (12)$$

$$(\nu - \hat{K})1 = 0, \quad (\nu - \hat{K})\mathbf{v} = 0, \quad (\nu - \hat{K})v^2 = 0. \qquad (13)$$

Within the LTE region, where the temperature gradient only slowly varies, the solution approximately has the Chapman–Enskog form,

$$h(\mathbf{r}, \mathbf{v}) = \frac{T(\mathbf{r}) - T_0}{T_0}\left[Q_4(v) - \tfrac{1}{2}\right] - \left(\frac{m}{2kT_0}\right)^{1/2} \mathbf{v}\cdot\frac{\nabla T(\mathbf{r})}{T_0} A(v). \qquad (14)$$

The function $A(v)$ satisfies the inhomogeneous equation

$$(\nu - \hat{K})\mathbf{v}A = \mathbf{v}(Q_4 - \tfrac{1}{2}), \qquad (15)$$

and the constraint

$$\int \mathrm{d}^3v M(\mathbf{v}) v^2 A(v) = 0 \qquad (16)$$

assuring that the gas is at rest. For the BKG model with constant collision rate ($\nu = \pi\bar{v}/6l$), A is given by

$$(m/2kT_0)^{1/2} \nu A(v) = Q_4(v) - \tfrac{1}{2}, \qquad (17)$$

which otherwise may be used as an approximation.

Close to the wire, where the temperature gradient strongly varies, expression (14) ceases to obey the Boltzmann equation. Hence no good approximation can be expected from extrapolating this expression down to the wire surface. According to Cercignani and Tironi [10], it is better to first undertake one iteration of the integral version of the linearized Boltzmann equation [5]. Since this is equivalent to letting each molecule suffer one collision, the procedure should take us closer to the steady-state solution.

If the outer surface is many mean free paths away, the mentioned equation states that

$$h^- = h(\mathbf{r}_0, -\mathbf{v})\big|_{v_r > 0} = \int_0^\infty \mathrm{d}t\, \mathrm{e}^{-\nu t} \hat{K} h(\mathbf{r}_0 + \mathbf{v}t, \mathbf{v}), \qquad (18)$$

where $\mathbf{r}_0$ represents a point on the wire surface and $\mathbf{v}t$ measures the path along the chosen trajectory. With expression (14) substituted, the integral yields the desired approximation for the incident distribution

$$h^- = \frac{T(\mathbf{r}_0) - T_0}{T_0}\left[Q_4 - \frac{1}{2} - \left(\frac{m}{2kT_0}\right)^{1/2} vA\right] + \left(\frac{m}{2kT_0}\right)^{1/2} vA \int_0^\infty v\,\mathrm{d}t \times \mathrm{e}^{-vt}\,\frac{T(\mathbf{r}_0 + \mathbf{v}t) - T_0}{T_0}. \tag{19}$$

Equations (13) and (15) have been taken into account, and a partial integration has been carried out. Substituting the logarithmic temperature profile,

$$T(\mathbf{r}) = T(\mathbf{r}_0) - \frac{qr_0}{\lambda}\ln\frac{r}{r_0}, \tag{20}$$

and definition (5), we finally have

$$h^- = -\frac{ql}{\lambda T_0}\left[\frac{\xi}{l}(Q_4 - \tfrac{1}{2}) + \left(\frac{m}{2kT_0}\right)^{1/2} vAJ(\mathbf{v}, r_0/l)\right], \tag{21}$$

$$J(\mathbf{v}, r_0/l) = \int_0^\infty v\,\mathrm{d}t\,\mathrm{e}^{-vt}\frac{r_0}{l}\ln\frac{r}{r_0}, \tag{22}$$

$$r^2 = (r_0 + v_r t)^2 + (v_\varphi t)^2.$$

The scattered distribution is obtained from (21) by aid of the surface-scattering operator [2],

$$h^+ = h(\mathbf{r}_0, \mathbf{v})\,|_{v_r > 0} = \hat{P}h^-. \tag{23}$$

Both parts of the distribution function are then used to express the heat flux at the wire surface in terms of a Maxwellian-flux average, as in equation (2),

$$q = j\langle\tfrac{1}{2}mv^2(h^+ - h^-)\rangle = -j\langle\tfrac{1}{2}mv^2(1 - \hat{P})h^-\rangle.$$

With h^- from equation (21), ζ from equation (7) and $\lambda = \frac{15}{2}ljk$ we obtain, after some cancellation and reshuffling, an expression for the correction term in equation (9)

$$R = \frac{2\alpha_{4J}}{15\alpha_{44}}\left\langle Q_4\left(\frac{m}{2kT_0}\right)^{1/2} vAJ\right\rangle. \tag{24}$$

The definition (3) has been invoked, and a new AC invented referring to $Q_J = (m/2kT_0)^{1/2}\,(vAJ - \langle vAJ\rangle)$. To have a check, we consider the high-pressure limit $l/r_0 \to 0$ when $J \to v_r/vl$. With A and v from the BGK model, the value (8) is immediately recovered.

Much too little is known about gas–surface scattering to make any use of such weird ACs as the α_{4J}. However, as (24) is only a rough approximation anyway, we may take recourse to the widespread opinion that for the same gas–surface pair the various ACs have similar values. For strong accommodation (α_{ij} close to 1) this is true trivially. On the other hand, if α_{44} is small, the first right-hand term in equation (9) is dominant, so that errors in R are unimportant. We therefore cancel the ACs in equation (24) and accept

$$R = \frac{2}{15}\left\langle Q_4\left(\frac{m}{2kT_0}\right)^{1/2} vAJ\right\rangle \tag{25}$$

as the final approximation.

For small r_0/l we find that

$$J \approx \frac{r_0}{l}\left(\ln\frac{v_c}{vr_0} - \gamma\right) + \left(\frac{r_0}{l}\right)^2\frac{v_r vl}{v_c^2}\left(\ln\frac{v_c}{vr_0} - \gamma + 1\right), \tag{26}$$

where $v_c = (v_\varphi^2 + v_r^2)^{1/2}$ is the velocity component in the cross-sectional plane. By manipulating equation (22) and substitution into (25), one can show that

$$R = \sum_{n=1}^{\infty}\left(\frac{r_0}{l}\right)^n\left(a_n\ln\frac{l}{r_0} + b_n\right). \tag{27}$$

Equation (26) leads to

$$a_1 = \langle B\rangle, \quad b_1 = \langle B[\ln(v_c/vl) - \gamma]\rangle, \tag{28a}$$

$$\begin{aligned} a_2 &= \langle Bv_r vl/v_c^2\rangle, \\ b_2 &= \langle (Bv_r vl/v_c^2)[\ln(v_c/vl) - \gamma + 1]\rangle, \end{aligned} \tag{28b}$$

where $B(\mathbf{v}) = \frac{2}{15}Q_4(m/2kT_0)^{1/2}\,vA$. For hard spheres and the BGK model, respectively, the values of the first few coefficients are:

$$\begin{aligned} a_1 &= 0.6689, \quad b_1 = -0.4616, \\ a_2 &= 0.6482, \quad b_2 = 0.0572, \end{aligned} \tag{29a}$$

$$\begin{aligned} a_1 &= 4/15, \quad b_1 = 0.0246, \\ a_2 &= 0.1396, \quad b_2 = 0.0748. \end{aligned} \tag{29b}$$

As already observed, R vanishes in the limit as $r_0/l \to 0$ irrespectively of the model, so that $\zeta \to 15l/4\alpha_{44}$. To understand this physically, we notice that molecules hitting the wire had their last collision within a layer a few mean free paths thick. According to equation (20), the extrapolated temperature within this layer hardly varies, so that $T(r_0)$ should now be regarded as a true temperature. Except for a tiny stream of molecules scattered by the wire, there is almost equilibrium within this layer. The regime is similar to a free-molecular one, except for the modified temperature of the incident distribution. The result $R = 0$ follows from this argument in a straightforward manner.

Two of the four integrations demanded by equations (22) and (24) can be carried out analytically, so that a double integral is left for numerical work. This has been done for the hard-sphere model, with the data for $A(v)$ from Pekeris [14], and for the BGK model, cf. equation (17). The BGK results agree with those deduced from values of the heat flux calculated by Cercignani and Tironi for large ratios r_1/r_0. The semilogarithmic plot (Fig. 1) also shows values of R derived from the more accurate variational results of

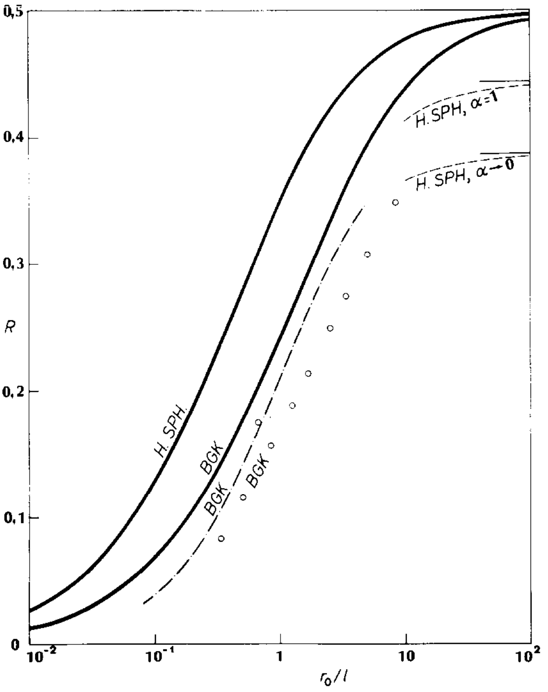

FIG. 1. Correction term for evaluation of α_{44}, in dependence of the reciprocal Knudsen number. Solid curves — values from equation (25) for hard spheres and for the BGK model; circles — from data in [11]; –.–.– — from data in [12]; – – – — from Eddington's method.

Bassanini *et al.* [11] and of Lang and Loyalka [12] for the same model. (The latter values are for $\alpha = 1$.)

As we have noticed, the approximate R obtained from the generalized Maxwell method does not depend upon the degree of accommodation if Maxwell's model for gas–surface scattering is adopted. Likewise, the calculations by Bassanini *et al.* fail to yield any such dependence, because of an oversimplified boundary condition. In fact, however, accommodation does have some influence, as one can show by Eddington's method [13]. For high pressures, hard-sphere molecules, and Maxwell's boundary condition the result is

$$R \approx 0.387 - 0.221\frac{l}{r_0} + \left(0.057 - 0.088\frac{l}{r_0}\right)\alpha, \quad (30)$$

where the coefficients have been derived by numerical integration. Unfortunately the method is too tedious to be of use for lower pressures; therefore, only the uppermost parts of the two extreme curves have been plotted.

4. COMMENTS

Before the data on Fig. 1 can be used for carrying out pressure corrections, one ought to worry about the differences between the various curves. Significant errors may originate not only from using a rough approximation, but also from adopting too crude models for intermolecular and gas–surface scattering. Switching from BGK to hard spheres shifts the curve towards the left, whereas improved approximations result in a shift to the right. Since real molecules are closer to hard spheres than to BGK, errors from taking the BGK model and from taking the generalized Maxwell method should partly compensate, so that the lower solid curve on Fig. 1 appears as a reasonable choice for practical use. However, we have to discard the upper part of the curve, where Eddington's method has disproved the limit $R \to \frac{1}{2}$ and also revealed considerable dependence upon accommodation. Little difficulty of this kind is to be expected for small r_0/l, since the limit $R \to 0$ on this side is exact.

For $r_0/l < 0.25$, that curve is reasonably well reproduced by equation (27) with the coefficients from (29b). For $0.25 < r_0/l < 4$, the empirical fit

$$R \approx 0.509 \ln\frac{r_0}{l} + 0.245$$

can be recommended. In either case the curves on Fig. 1 indicate that the absolute error in the evaluated R is not likely to be larger than about 0.05, and less for very small r_0/l. In case of strong accommodation, the corresponding error in α_{44} from equation (9) amounts to at most 5 %. If for some reason high pressures must be used (say $r_0/l > 10$), Eddington's approximation may be applied, with α_{44} iteratively substituted for α in equation (30). In case of weak accommodation one need not worry, even if R is burdened with a somewhat larger uncertainty, because this term then only insignificantly contributes to $1/\alpha_{44}$.

If the disappointingly large uncertainty of the pressure correction is to be made smaller, one should not rely upon specific values of the coefficients in equation (27), but attempt a least-square fit instead. That is, one ought to measure q for different pressures (all low enough) but for the same wire temperature. After evaluating

$$\frac{2jk\Delta T}{q} - \frac{4}{15}\frac{r_0}{l}\ln\frac{r_1}{r_0} = \frac{1}{\alpha_{44}} - R$$

$$\approx \frac{1}{\alpha_{44}} - \sum_{n=1}^{N}\left(\frac{r_0}{l}\right)^n\left[a_n \ln\frac{l}{r_0} + b_n\right], \quad (31)$$

where the truncated expansion (27) is substituted as a tentative approximation, one should determine the optimal values of α_{44} as well as of a_n and b_n, $n = 1, 2, \ldots, N$. It suffices to take $N = 1$ and $N = 2$ for $r_0/l < 0.1$ and for $r_0/l < 0.25$, respectively, if the values of R on Fig. 1 are to be matched to with ± 0.005. This corresponds to an uncertainty of at most $\pm 0.5\,\%$ in α_{44}. Errors due to other causes are presumably smaller still, since such a method is likely to reach a close fit to the correct curve. Higher pressures cannot be recommended, because too many terms in equation (31) would be required.

A word must be said about possible generalization to polyatomic gases. Formally this looks simple enough: the factor $2k$ in equation (4) and elsewhere must be replaced by $(C_V + \frac{1}{2}k)$, where C_V is the heat capacity per molecule. However, such a procedure is subject to doubt because rotational and vibrational energy is exchanged less vigorously in intermolecular collisions than translational energy [15]. Consequently, in the region close to the wire one would have to reckon with quasi-LTE, described by different temperature profiles for internal and translational degrees of freedom. Two or several different jump coefficients would show up. Partial accommodation coefficients [2] would presumably be involved in the analysis, so that measurements at different pressures might yield a clue about these otherwise elusive coefficients. Further theoretical investigation is needed before reliable conclusions can be made in this respect.

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CORRECTION POUR LA PRESSION EN MESURE DU COEFFICIENT D'ACCOMMODATION DE L'ENERGIE

Résumé — La mésure du coefficient Knudsen d'accommodation de l'énergie (α_{44}) avec l'instrument à fil chaud exige une correction pour les collisions intermoleculaires dans le gaz. Les méthodes traditionelles pour cette correction sont discutées, et une nouvelle méthode proposée. Pour le régime des basses pressions l'incertitude de l'α_{44} obtenu ainsi peut être reduit au-dessous de quelques pourcents.

DRUCKKORREKTUR BEI MESSUNGEN VON ENERGIEAKKOMMODATIONSKOEFFIZIENTEN

Zusammenfassung — Bei Messungen des Knudsenschen Akkommodationskoeffizienten für Energie (α_{44}) mit dem Hitzdrahtinstrument muß eine Korrektur angewendet werden, die den Stössen der Moleküle im Gas Rechnung trägt. Die zu diesem Zweck üblichen Methoden werden diskutiert und eine neue Methode vorgeschlagen. Für das Niederdruckregime kann man die Unsicherheit des so bestimmten α_{44} unter wenige Prozent herabdrücken.

КОРРЕКТУРА ПО ДАВЛЕНИИ В ИЗМЕРЕНИЯХ КОЭФФИЦИЕНТА АККОМОДАЦИИ ЭНЕРГИИ

Аннотация — В измерениях кнудсеновского коэффициента аккомодации энергии (α_{44}) помощью инструмента с нагретой проволочкой нужная корректура по межмолекулярним столькновениям в газе. Дискутуется традициональные методы для этой корректури и предлагается новый метод. Для режима малого давления возможно снизить неопределенность получимого α_{44} ниже несколько процентов.