AUTHORS' REPLY TO A. S. NEVSKII

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Dr. Nevskii's remarks on our paper [1] were, apparently, motivated by the fact that he analyzes our method from the point of view of its applicability to selective gases, whereas it was our intention to apply it only to gases which could be regarded as "gray" radiators. This misunderstanding is due to the fact that in our paper [1] we have not specified clearly enough the range of applicability of our method, and our choice of an example was unfortunate.

There is no question that in the furnaces of steam boilers and in industrial furnaces radiation is due to triatomic gases. However, it is known that in the combustion of solid fuels part of the radiation is due to soot and fuel particles suspended in the combustion gases. Under certain conditions the radiation due to these particles may be of the same order as that due to the triatomic gases. Such dusty furnace gases, in emitting (absorbing) layers of 0.85 m thickness (working length of the radiometer tube) can, in our opinion, be regarded as practically "gray." Thus, in this range of application our simplifications are admissible.

As regards a selectively radiating furnace gas, for lack of practical interest we have not analyzed the relation between the emission and absorption coefficients. The values of the coefficients k_{0C} and k_C quoted by Nevskii, which are taken from Figs. 62, 63, 66, and 67 of [2], show a large disparity, by a factor of 15–30. Unfortunately, the table and Figs. 66 and 67 of [2] do not show the values of px for k_{0C}. Moreover, Figs. 62 and 63 of [2] correspond to small thicknesses of the absorbing layer and are of no interest for boilers and industrial furnaces. If one compares the values of k_{0C} and k_0 for more realistic conditions ($px \gg 0.1$ m · atm), the disparity between the coefficients is much smaller.

Considering Eq. (4) of [1] and referring to Figs. 17 and 18 of [3], Nevskii notes that the mean emission (absorption) coefficient averaged over the length of the beam should be a function of the beam length. This is strictly correct for selective gases, whereas the above equation was derived for an isothermal gas with "gray" properties.

The agreement between the experimental values of k with existing data on CO_2 and H_2O can be explained by the fact that in the experiments the emission of the gases in the radiometer tube (Q') was negligible as compared to Q_0 and Q. Consequently, the coefficient measured was the absorption coefficient k_C. The experimental values of the coefficients were compared with the data of Figs. 7–18, 7–19, and 7–20 of [4]. Reference [8] quoted in [1] was introduced by mistake.

Equation (10) of [1], used to determine k_0, is a very rough approximation to the solution of Eq. (8). Equation (10) contains a misprint, the correct form being

$$k_0 = [(Q_0 - Q)\,T_1]\left\{T_0 l\left[Q_0 - \frac{\sigma_0 T_1^4}{\pi}\left(1 - 1.5\frac{\Delta T}{T_1}\right)\right]\right\}^{-1}.$$

A more exact solution of (8) yields

$$k_0 = 4\Delta T\,(Q_0 - Q) \times \times\left(T_0 l\left\{4\frac{\Delta T}{T_1}\left[Q_0 - \frac{\sigma_0 T_1^4}{\pi}\left(1 - 1.5\frac{\Delta T}{T_1}\right)\right] + Q_0 - Q\right\}\right]^{-1}.$$

Numerical calculations show that the values of k_0 obtained by these equations differ only slightly, and agree within 15% with the exact solution of (8) with the assumptions (9) of [1].

We are grateful to Dr. A. S. Nevskii for his valuable remarks.

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