

REPLY TO Comments on "rotational cooling in a seeded ocs beam"

W.L. MEERTS and A. DYMANUS

Fysisch Laboratorium, Katholieke Universiteit, Nijmegen, The Netherlands

Received 18 August 1978

In his comment, Kukolich concludes that the differences in his earlier experiment [1] and our more recent [2] prevent any meaningful comparisons from being drawn between the two sets of results. This conclusion is incorrect, because the rotational temperature obtained depends almost entirely on the p_0d product, which is practically the same in the two cases (2.0×10^{-2} in ref. [1] and 4.4×10^{-2} bar mm in ref. [2]).

In his comment, Kukolich also emphasized that a Boltzmann distribution is found in our experiment because of scattering in the beam forming region. This possibility is clearly ruled out in the discussion in paper [2], but two additional arguments should be made. First, if scattering were responsible for the distribution, the temperature obtained would be ≈ 300 K because source, skimmer and background gas are at room temperature. Secondly, the number of collisions required to establish a Boltzmann distribution by

scattering would result in a large reduction of the total beam intensity and disturb the velocity distribution.

As pointed out further by Kukolich in his comment one possible explanation for the disagreement may lie in the fact that the conclusions from our experiment and that of Kukolich are deduced from measurements in different vibrational states. However, this would require different rotational relaxation rates for molecules in different vibrational states. Until the relaxation processes in a supersonic expansion are better understood, it seems more promising to adopt the simplest possible model and assume the two rates to be equal.

References

- [1] S.G. Kukolich, D.E. Dales and J.H.S. Wang, *J. Chem. Phys.* **63** (1975) 3173.
- [2] W.L. Meerts, G. ter Horst, J.M.L. Reinartz and A. Dymanus, *Chem. Phys.* **35** (1978) 253.