in the large thermal gradient normal to the surface of the hot filament. We are confident of success in determining the atomic arrangement in rhombohedral boron when we shall have completed the quantitative measurement of the numerous *h k l* intensity data.

Thanks are due Dr. Gordon S. Smith and Mr. D. B. Sullenger for taking some of the photographs.

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THE PREMIXED OZONE–CYANOGEN FLAME[1,2]

Sir:

The pure ozone decomposition flame to oxygen[3] and the premixed ozone–hydrogen flame[4] were recently described. A premixed pure ozone flame with a *carbon* compound, namely, cyanogen, has now been achieved.

It was first established, in static experiments, that cyanogen and pure ozone can be mixed and stored for a considerable time without reaction. Thus the mixture $3(CN)_2 + 4O_3$ was kept in a 100-cc. Pyrex vessel, at 1000 mm. at 0° for 2.0 hours with no noticeable change in pressure; after this time cyanogen was frozen out at −78°, the O_3 pumped off and the volumes of the separated gases were found to be essentially equal to their original volumes. Identical results were obtained with the mixture $3(CN)_2 + 2O_3$.

The results of our laminar flame measurements are given in Fig. 1 and compared with O_2. Burning velocities of $(CN)_2$–O_3 mixtures containing 25.0, 33.3, 40.0 and 100.0 mole % O_3 were, respectively, 60 ± 3, 242 ± 12, 285 ± 6 and 420 ± 6 cm./sec. A mixture beyond the stoichiometric point, on the O_3-rich side, containing 50.0 atom % O detonated immediately upon ignition. The same apparatus was used as in the O_3–H_2 measurements[4]; the desired mixture was stored over water in a Pyrex gas holder, dried by passing through a trap cooled to −19°. (H_2O-content of gas = 0.11 mole %) and ignited by a hot Pt-wire from an aluminum burner tip (i.d. = 0.66 mm.). Since flame velocities of $(CN)_2$–O_2 flames are increased by traces of H_2O,[5] we used the same apparatus and the same conditions to measure $(CN)_2$–O_2 flames.

The shapes of the three O_3 flames described are widely different.[3,4] Although the O_3-rich side of the O_3–H_2 and $(CN)_2$–O_3 systems could not be explored due to their detonability, it is unlikely that the latter system will show the high peak of the O_3–H_2 system. All $(CN)_2$–O_3 mixtures burn comparatively slowly and even at the $2CO + N_2$ (*i.e.*, = 33.3 atom % O) point, the velocity is substantially below that of pure ozone.

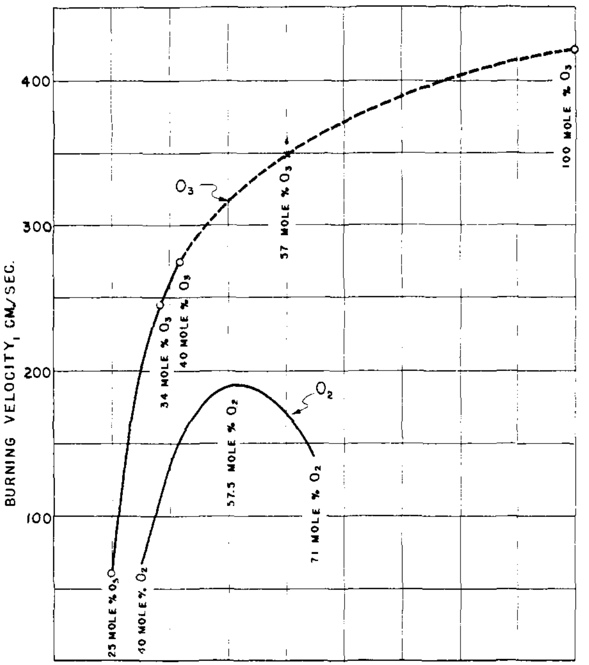

Fig. 1.—Burning velocities of $O_3 + (CN)_2$ and $O_2 + (CN)_2$ mixtures (at 0° initial gas temperature and 1 atm.).

All flames on the $(CN)_2$-rich side up to and including the mixture burning to $2CO + N_2$ burn uniformly, noiselessly, as brightly as an electric arc and with a pink-violet color. The $2(CN)_2 + O_3$ flame is particularly bright and has a different characteristic blue green color.

Their temperatures can be calculated[6] with great accuracy (± 2°K.); one of them is compared with the corresponding O_2 flame[7,8] below

Gas composition	°D. 1.0 Atm.	10.0 Atm.
$(CN)_2 + O_2$	4856	5025
$3(CN)_2 + 2O_3$	5208	5506

In these calculations the value of $\Delta H_f^{25°}$ for ozone = +33.98 and for cyanogen = +73.85 kcal./mole was used.

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[1] Paper presented at the Sixteenth International Congress on Pure and Applied Chemistry, Paris, France, July 18–24, 1957.

[2] This research was supported by the United States Air Force through the Air Force Office of Scientific Research of the Air Research and Development Command under Contract No. AF-18(600)-1475.

[3] A. G. Streng and A. V. Grosse, THIS JOURNAL, **79**, 1517 (1957).

[4] A. G. Streng and A. V. Grosse, *ibid.*, **79**, in press (1957).

[5] R. S. Prokaw and R. N. Pease, *ibid.*, **75**, 1454 (1953).

[6] Acknowledgment is made to the Reaction Motors, Inc., and to Mrs. Marianne Stoltenberg for their help with some of the calculations.

[7] J. B. Conway, R. H. Wilson, Jr., and A. V. Grosse, THIS JOURNAL, **75**, 499 (1953).

[8] J. B. Conway, W. F. R. Smith, W. J. Liddell and A. V. Grosse, *ibid.*, **77**, 2026 (1955).

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DERIVATIVES OF 1-THIA-4,5-DIAZACYCLOHEPTA-2,4,6-TRIENE. III. CORRECTIONS AND ADDENDUM

Sir:

As a result of the unintentional return of an incompletely corrected proof, there are certain errors in our recent publication dealing with isomerism of derivatives of dibenzo-1-thia-4,5-

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[1] H. H. Szmant and Y. L. Chow, THIS JOURNAL, **79**, 4382 (1957).