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On the upper atmospheric chemiluminescent emission observed upon release of aluminum vapor and its compounds

Gole, J. L.; Kolb, C. E.
Journal of Geophysical Research, vol. 86, Oct. 1, 1981, p. 9125-9136.

Upper atmospheric chemical releases of aluminum vapor and gaseous aluminum compounds have been used to determine a number of atmospheric properties in the 90 to 220-km altitude range. Visible radiation from nighttime releases is due to a chemiluminescent reaction which has been traditionally identified as the radiative combination of AlO with atomic oxygen to form electronically excited AlO2. Atmospheric release data are reviewed which eliminate this traditional mechanism. Results from laboratory experiments are presented which indicate key roles for electronically excited HAlOH formed in a direct insertion reaction of atomic aluminum with water vapor and AlO (asterisk)(A2pi) formed via the reaction of oxygen atoms with weakly bound aluminum adducts. These new mechanisms significantly influence the nature of input data for atmospheric models.

Keywords: ALUMINUM, ATMOSPHERIC CHEMISTRY, CHEMILUMINESCENCE, METAL VAPORS, NIGHTGLOW, UPPER ATMOSPHERE, ALUMINUM COMPOUNDS, ATMOSPHERIC MODELS, MOLECULAR EXCITATION, OXYGEN RECOMBINATION, REACTION KINETICS, SPECTRUM ANALYSIS, WATER VAPOR
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