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### An Analysis of the Visible Chemiluminescence Observed in the Gas-Phase Oxidation of Aluminum and Its Compounds

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**Abstract:** A mechanism based on the population of and emission from the (A doublet Pi) and/or lowest-lying quartet sigma(+) and quartet Pi states of AIO is suggested as an explanation for the visible chemiluminescence often observed in the gas-phase oxidation of aluminum. Data from upper atmospheric chemical release experiments utilizing aluminized grenades, aluminized burners, and **trimethylaluminum** are examined, and AIO(\*) pumping steps based on the reaction of molecules containing loosely bound aluminum atoms with atomic oxygen are suggested. Previously proposed theories are shown to be unable to reproduce reasonably the observed data. The results of selected, recent laboratory experiments involving chemiluminescent reactions of metal atoms and dimers with electrophilic atoms and molecules are discussed in terms of the proposed mechanism. Several possible experiments to test the proposed mechanism are suggested.

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**Description:** Final technical rept. Jul 1973-Jan 1974

**Pages:** 45

**Report Date:** APR 1974

**Contract Number:** F3060273C0162, ARPAORDER1649

**Report Number:** 0165087

 **Keywords relating to this report:**

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