

Electronic Energy Partitioning in the Reactions of Metastable $\text{Mg}^*(^3\text{P}_J)$ Atoms with F_2 , Cl_2 , Br_2 , I_2 , ICl , IBr

P. Kierzkowski, B. Pranszke, A. Kowalski, and M. Menzinger^a

Institute of Experimental Physics, University of Gdansk, PL-80-952 Gdansk, Poland

^a Department of Chemistry, University of Toronto, Toronto, ON M5S 1A1, Canada

Reprint requests to Dr. A. K.; Fax: (00-48)(58)341-3175; E-mail: fizako@univ.gda.pl

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Chemiluminescent reactions of metastable $\text{Mg}^*(^3\text{P}_J)$ atoms with F_2 , Cl_2 , Br_2 , I_2 , ICl , IBr molecules were studied in a beam-gas experiment. For all homonuclear targets the $\text{MgX}(A^2\Pi - X^2\Sigma^+)$ emission was observed, but for ICl and IBr reactants the $\text{MgI}(A-X)$ emission was absent and only $\text{MgCl}(A-X)$ or $\text{MgBr}(A-X)$ spectra were found. In addition, for the I_2 , IBr , ICl , Br_2 reactions, broad pseudocontinua extend from above 400 nm into the infrared. These pseudocontinua are tentatively attributed to the $\text{MgI}, \text{MgBr}(B'^2\Sigma^+ - X^2\Sigma^+)$ transition. The total attenuation cross sections, chemiluminescence cross sections and quantum yields were measured. The quantum yields are all below 5%. The results are analyzed using information theory. The low yields for the $\text{Mg}^* + \text{I}_2$ system are explained by a barrier in the entrance channel. For other reactions the low yields are most probably caused by predissociation of the $\text{MgX}^*(A^2\Pi)$ products.

Key words: Chemiluminescence; Energy Transfer; Atomic Collisions; Molecular Collisions; Luminescence.