

EVALUATION OF THE EXOTHERMICITY OF THE CHEMI-IONIZATION REACTION $\text{Sm} + \text{O} \rightarrow \text{SmO}^+ + \text{e}^-$

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The chemi-ionization reaction $\text{Sm} + \text{O} \rightarrow \text{SmO}^+ + \text{e}^-$ has been used for chemical release experiments in the thermosphere. This reaction was chosen, in part, because the best available data indicated that it is exothermic by 0.35 ± 0.12 eV. Low ion yields in the initial atmospheric release experiments raised questions concerning the accuracy of the ionization energy (IE) for SmO and the bond dissociation energy (BDE) of SmO^+ . New measurements of the BDE, obtained using a selected ion flow tube and guided ion beam techniques, yielded a more precise value of 5.73 ± 0.07 eV. The ionization energy of SmO was reexamined using pulsed-field ionization zero kinetic energy (ZEKE) photoelectron spectroscopy. The value obtained, 5.7427 ± 0.0006 eV, was significantly higher than the literature value. Combined with literature bond energies of SmO, this IE indicates an exothermicity for $\text{Sm} + \text{O} \rightarrow \text{SmO}^+ + \text{e}^-$ of 0.14 ± 0.17 eV, independent from and in agreement with the value deduced from the guided ion beam measurements. The implications of these results for interpretation of chemical release experiments are considered.