MASS-ANALYZED THRESHOLD IONIZATION OF LANTHANUM OXIDE CLUSTERS: La_2O_2 AND La_3O_4

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Lanthanum oxide clusters are produced by laser vaporization in a pulsed cluster source and identified by photoionization mass spectrometry. Vibrationally resolved ion spectra are obtained with mass-analyzed threshold ionization (MATI) spectroscopy. The MATI spectra of La_2O_2 and La_3O_4 exhibit a very strong 0-0 transition, indicating similar geometries for the neutral and ionized clusters and a very weakly bonding or non-bonding electron ejected from an outmost molecular orbital. The ionization energies of La_2O_2 and La_3O_4 are measured to be 36937(5) and 28028(5) cm^{-1}, respectively. In addition, the spectra of both clusters display a number of vibrational intervals that are associated with metal-metal, metal-oxygen, and oxygen-oxygen vibrations. Preliminary data analysis shows that the La_2O_2 cluster has a D_{2h} planar structure and La_3O_4 has a C_{3v} cage-like structure, both with alternating La-O-La bonds. The spectra may be assigned to the $^2Ag \leftarrow {}^1Ag$ transition in the case of La_2O_2 and $^1A_1 \leftarrow {}^2A_1$ in La_3O_4 .