

THRESHOLD IONIZATION OF $\text{La}(\text{C}_5\text{H}_8)$ FORMED BY La-MEDIATED DEHYDROGENATION OF 1-PENTENE

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$\text{La}(\text{C}_5\text{H}_8)$ was formed by La reaction with 1-pentene ($\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}_3$) in a laser-vaporization supersonic molecular beam source and characterized with mass-analyzed threshold ionization (MATI) spectroscopy. The MATI spectrum displays an origin band at $38988(5) \text{ cm}^{-1}$ and three vibrational intervals of 130, 294, and 415 cm^{-1} . The $\text{La}(\text{C}_5\text{H}_8)$ complex is identified as a five-membered metallacycle in C_1 point group, with the doublet and singlet being the lowest energy states of the neutral and cation, respectively. The energy at 38998 cm^{-1} corresponds to the adiabatic ionization energy of the complex, and the three vibration intervals in the order of the frequency increase are assigned to the terminal CH_3 torsion, asymmetric La-ligand stretch, and symmetric La-ligand stretch excitation of the ion. The La + 1-pentene reaction will also be compared with La reactions with other five-carbon hydrocarbon molecules, such as isoprene, 1-pentyne, and 1,4-pentadiene.