La(C₅H₈) was formed by La reaction with 1-pentene (CH₂=CH-CH₂-CH₃) 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) cm⁻¹ and three vibrational intervals of 130, 294, and 415 cm⁻¹. The La(C₅H₈) complex is identified as a five-membered metallacycle in C₁ 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 CH₃ 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.