The cyclopentadienyl dialuminum complex, \((\text{C}_5\text{H}_5)\text{Al}_2\), is synthesized in a supersonic molecular beam, where aluminum atoms and dimers are produced by laser vaporization, and cyclopentadienyl radicals are generated from photolysis of cyclopentadiene (\(\text{C}_5\text{H}_6\)) molecules. Vibrationally resolved electronic spectra of the complex are measured using pulsed-field ionization zero electron kinetic energy spectroscopy. Three initial conformations are considered for the complex: one with an Al atom binding to each side of the \(\text{C}_5\text{H}_5\) ring and two others with an \(\text{Al}_2\) molecule lying vertically or horizontally on one side of the ligand ring. A structure with the \(\text{Al}_2\) molecule lying vertically on the top of the \(\text{C}_5\text{H}_5\) ring is identified by comparing the spectroscopic measurements to \textit{ab initio} calculations. The \((\text{C}_5\text{H}_5)\text{Al}_2\) neutral complex has a \(^3\text{A}^\prime\) ground electronic state in Jahn-Teller distorted \(C_2\) symmetry and the corresponding ion has a \(^1\text{A}_1\) ground state in \(C_{5v}\) symmetry. The ionization energy of \((\text{C}_5\text{H}_5)\text{Al}_2\) is measured to be 40690(5) \text{cm}^{-1}. For the cationic \(^1\text{A}_1\) state, the frequencies of the metal-ligand stretching, metal-metal stretching, and metal-ligand bending modes are 482, 175, and 50 \text{cm}^{-1}, respectively. In addition, a \((\text{C}_5\text{H}_5)\text{-Al}_2\) bending mode of the neutral \(^2\text{A}^\prime\) state is measured to be 26 \text{cm}^{-1}.