SPECTROSCOPY IDENTIFICATION OF BENZYL-TYPE RADICALS GENERATED BY CORONA DISCHARGE OF PRECURSORS OF MIXED SUBSTITUENTS

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We generated vibronically excited but jet-cooled benzyl-type radicals from corona discharge of precursor of mixed substituents using a technique of corona excited supersonic expansion coupled with a pinhole-type glass nozzle, from which the visible vibronic emission spectra were recorded with a long-path monochromator. The spectra exhibit the intensity variation of each species with discharging voltage, indicating the radical species generated in corona discharge is highly sensitive to excitation. From the analysis of the spectra, we found the Cl substituent is replaced in preference to the F substituent by the hydrogen atoms liberated from the dissociation of the C-H bond of the methyl group of the precursor, from which we proposed the possible mechanism for the elimination reaction of substituent in terms of the bond dissociation energy. Additionally, we obtained an accurate electronic energy in the $D_1 \rightarrow D_0$ transition and the vibrational mode frequencies of newly detected benzyl-type radicals in the ground electronic state by comparison with those of $ab\ initio$ calculations and the known spectroscopic data of precursors for the first time.