

The ground state rotational constants of ethylene ($^{12}\text{C}_2\text{H}_4$) isotopologues by high resolution Fourier transform infrared (FTIR) spectroscopy

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Abstract:

The ground state rotational parameters and centrifugal distortion constants of several ethylene isotopologues - $^{12}\text{C}_2\text{HD}_3$, *cis*- $^{12}\text{C}_2\text{H}_2\text{D}_2$, *trans*- $^{12}\text{C}_2\text{H}_2\text{D}_2$, $^{12}\text{C}_2\text{H}_3\text{D}$, $^{12}\text{C}_2\text{D}_4$, $^{12}\text{C}^{13}\text{CH}_4$, $^{13}\text{C}_2\text{H}_4$, $^{13}\text{C}_2\text{HD}_3$ and $^{13}\text{C}_2\text{D}_4$ - have been derived in separate analyses of their transitions in their vibrational bands using high-resolution Fourier transform infrared (FTIR) spectra. The FTIR spectra, which were measured at resolutions of 0.0063 cm^{-1} or 0.00096 cm^{-1} , allowed for the analyses of their rotation-vibrational structures and the derivation of ground state combination-differences (GSCDs). The ground state rotational and centrifugal distortion constants were then typically fitted to the GSCDs using the Watson's Hamiltonian model. Here these experimental parameters are compared with those of the parent molecule $^{12}\text{C}_2\text{H}_4$ to give a general overview of the ground state rotational structures of ethylene and its isotopologues.