

THE PERMANENT ELECTRIC DIPOLE MOMENTS OF THE $^3\Pi$ and $^3\Delta$ STATES OF RUTHENIUM MONOCARBIDE, RuC

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Elucidating the structure and function of the chemically pervasive transition metal-carbon bond is a problem of both fundamental and applied scientific interest. Recent insight into the nature of the metal-carbon bond has been due to high-resolution gas-phase spectroscopy of the diatomic monocarbides, where measurement of permanent electric dipole moments and hyperfine structure are particularly informative. Ruthenium monocarbide has garnered recent interest^{a b c d e f} due to its ease of production, intense visible electronic transitions and large magnetic hyperfine structure. We report on the investigation of the (0,0) $\{12.7\}^3\Pi_2 - \{0.1\}^3\Delta_3$ and (0,0) $\{13.9\}^3\Pi_1 - \{0.9\}^3\Delta_2$ band systems using high-resolution laser induced fluorescence spectroscopy. Stark shifts of the ^{102}RuC and ^{104}RuC isotopomers were analyzed to produce the magnitude of the permanent electric dipole moments for the $^3\Delta_3$, $^3\Delta_2$, $^3\Pi_2$ and $^3\Pi_1$ states. The measured moments prompt a discussion of the electronic structure and bonding in the $^3\Delta$ and $^3\Pi$ electronic states. Dipole moment trends are most informative when coupled to molecular orbital correlation diagrams. The measured dipole moments can be used as true benchmarks for rigorous electronic structure calculations. A comparison with isovalent FeC is made.^g

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