Mossbauer spectroscopy of Tin compounds.

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Abstract:

The Mossbauer spectrometer has been used in the transmission geometry to measure the isomer shifts and quadrupole splitting of tin and some of its inorganic compounds. The spectrometer has a Moire interferometer for absolute velocity calibration and the velocity data are fitted to a polynomial by the method of least squares. As a check on the velocity calibration, a natural iron foil absorber has been used. The ratio of the g-factors extracted from the iron data is in agreement with published values.

The Mossbauer spectral data has been fitted with a sum of Lorentzians and the isomer shift and quadrupole splitting values obtained from these fits are in good agreement with published ones. Using s-electron densities Calculated from relativistic Hartree-Fock method for the various oxidation states of tin the fractional change in nuclear charge radius $\Delta R/R$ following a gamma transition has been calculated as $(+2.05 \pm 0.17) \times 10^{-4}$. This is in good agreement with published values.

From molecular orbital calculations, a configuration of $5s^{1..2}5p^{2..8}$ has been suggested for α-tin. No equivalent data exists for β-tin. However, since the isomer shift is directly proportional to the s-electron density at the nuclear site, the measured isomer shift value has been used to suggest a configuration of $5s^{1.42}\ 5p^{2.8}$ for β-tin. This is consistent with the saner shift values for the two allotropes of tin.

Keywords: Transmission/ geometry/ isomer/ inorganic compounds/ calibration/ spectrometer/ quadrupole/ electron/ gamma rays/ orbital transmission/ allotropes/ tin

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