

Hyperfine Interactions in Hexavalent Iron Compounds

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Although dark-purple ferrate has been known from the beginning of XVIII-th century, and its tetrahedral FeO_4^{2-} ions studied in some detail in alkaline solutions and solids, such as potassium ferrate(VI), so far only scarce information is available on hexavalent iron compounds with other coordination polyhedra or other ligands. Ferrates(VI) of all alkali metals, strontium and barium have been described (see e.g. [1-4]), and mixed potassium-strontium ferrate(VI) [5] and derivatives with quaternary ammonium cations [2] are also known. Only about half of these known ferrates were characterised with their Mössbauer spectra. At room temperature, Mössbauer spectra of ferrates(VI) consist of a single absorption band with its isomer shift between -0.95 and $-0.88 \text{ mm}\cdot\text{s}^{-1}$ relative to α -iron which, with the exception of SrFeO_4 , transform into a magnetic sextet at low temperatures. No quadrupole splitting was clearly observed in those spectra.

In this report, we present the results of synthesis of a new mixed potassium-sodium ferrate(VI), $\text{K}_3\text{Na}(\text{FeO}_4)_2$, with glaserite-like structure. This compound shows a well-resolved doublet splitting in Mössbauer spectra. At room temperature, it is characterised by isomer shift $\delta = -0.85 \pm 0.01 \text{ mm}\cdot\text{s}^{-1}$ (relative to α -iron), quadrupole splitting $\Delta = 0.21 \pm 0.01 \text{ mm}\cdot\text{s}^{-1}$ and half-width $\Gamma = 0.22 \pm 0.01 \text{ mm}\cdot\text{s}^{-1}$. No magnetic ordering has been observed down to liquid helium temperature. Ferrates (VI) and (IV) formation at high-temperature synthesis, as revealed by the Mössbauer spectroscopy, will also be discussed.

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