

miscellaneous Mössbauer topics

www.hyperfinecourse.org

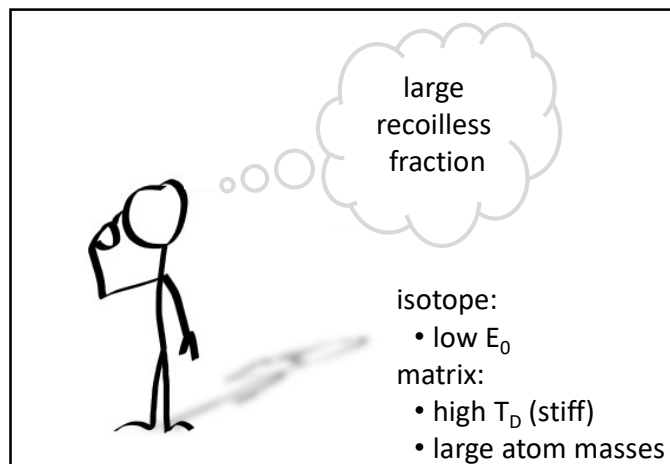
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miscellaneous Mössbauer topics

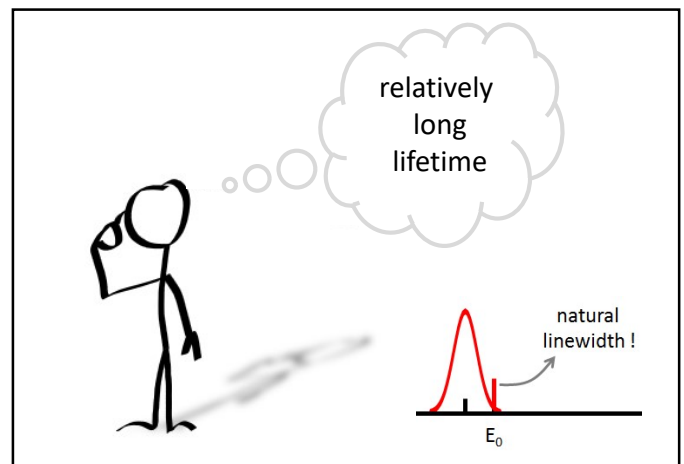
1. suitable isotopes

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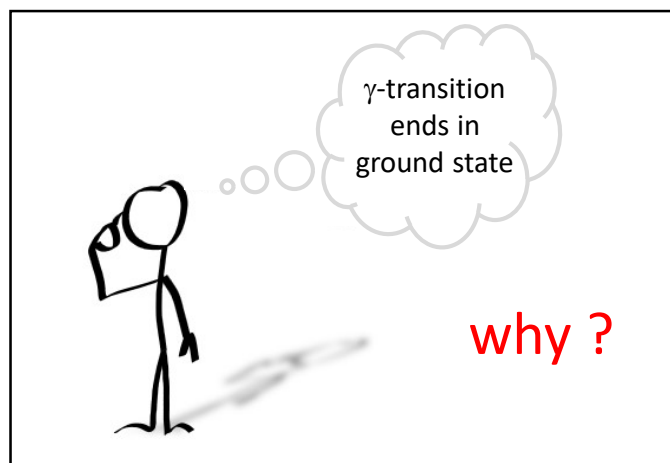
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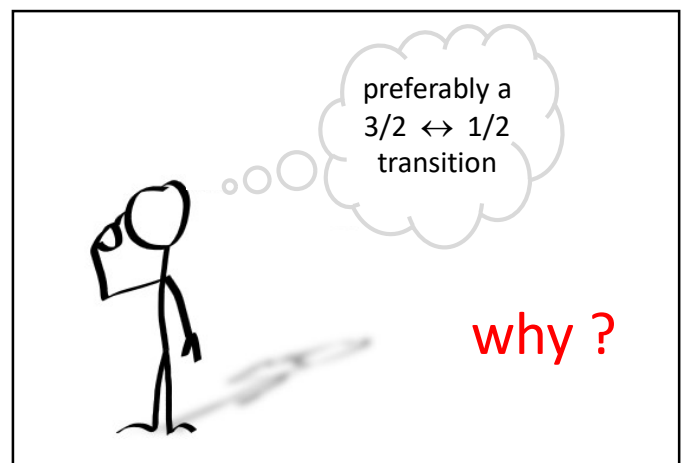
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suitable parent activity

- easy of production
- chemical properties
- life-time

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click on element to see details : <http://www.medic.dicp.ac.cn/Resources.php>

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⁵⁷Co ($t_{1/2} = 271.7$ days)

Electron Capture

Isotopic abundance 2.14(1)%

Ground state properties:
 $\mu = 0.09062(3)$ nm

Excited state properties:
 $E = 14.412497(3)$ keV
 $E_R = 1.95883310(4) \cdot 10^{-3}$ eV
 $Q_{IC} = 8.20$
 $\sigma = 2.56 \cdot 10^{-18}$ cm²
 $\mu = -0.1549$ nm
 $Q = 0.21(2)b$
 $T_{1/2} = 98.3(3)$ ns
 $W = 0.194(2)$ mm/s

Source Production:
⁵⁶Fe(p, γ)
⁵⁵Mn($\alpha, 2n$)
⁵⁷Fe(n, p)
⁵⁴Cr(α, p)

Unit Conversion:
1mm/s = 11.6248 MHz
1mm/s = 4.80766 $\cdot 10^{-8}$ eV
1mm/s = 110.076 MHz
1mm/s = 4.55243 $\cdot 10^{-7}$ eV

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2. on-line techniques

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The Radioactive Ion Beam facility

<http://isolde.web.cern.ch>

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Hyperfine Interactions 129 (2000) 371–390 371

Mössbauer spectroscopy at ISOLDE

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^b EP Division, CERN, CH-1211 Geneva 23, Switzerland

Applications of radioactive ion beams produced at the ISOLDE facility for Mössbauer studies of probe atoms in solids are presented. Examples are given for a site-selective incorporation on different substitutional sites in compound semiconductors by ion implantation and thermal annealing of the radiation damage resulting from the implantation. The interactions of the probe atoms with lattice defects created in the implantation process have been studied to elucidate likely causes for the site-selective implantation mechanism. The technique has enabled to determine the electronic densities at electrically active substitutional probe atoms, having shallow donor or acceptor states as well as states deeper in the band gap. The results are in good agreement with theoretical results from local density calculations. Methodological aspects of the Mössbauer emission techniques employed at ISOLDE are compared to alternative accelerator based techniques and the consequences of the application of different precursor isotopes to the ⁵⁷Fe Mössbauer isotope are treated in detail for ⁵⁷Fe in silicon. Finally, results obtained for the magnetic hyperfine interactions of 5 sp impurities associated with vacancies in ferromagnetic metals are discussed.

<http://dx.doi.org/10.1023/A:1012693229011>

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3. CEMS

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Isotopic abundance 2.14(1)%

Ground state properties:
 $\mu = 0.09062(3)$ nm

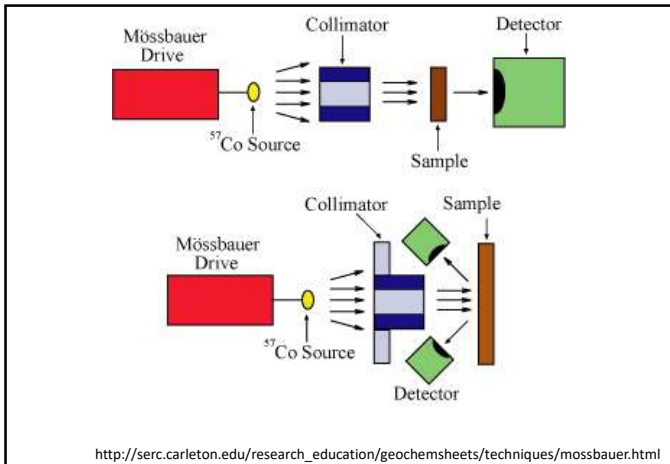
Excited state properties:
 $E = 14.412497(3)$ keV
 $E_{\text{ex}} = 1.95883310(4) \cdot 10^{-3}$ eV
 $Q_{\text{IC}} = 8.20$
 $\sigma = 2.56 \cdot 10^{-12}$ cm²
 $\mu = -0.1549$ nm
 $Q = 0.21(2)$ b
 $T_{1/2} = 98.3(3)$ ns
 $W = 0.194(2)$ mm/s

Source Production:
⁵⁶Fe(p,γ)
⁵⁵Mn(α,2n)
⁵⁷Fe(n,p)
⁵⁴Cr(α,p)

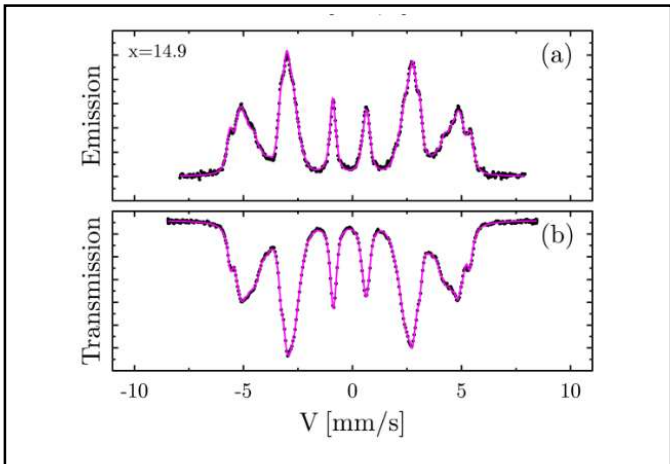
Unit Conversion:
1mm/s = 11.6248 MHz
1mm/s = 4.80766 · 10⁻⁹ eV

$E = 136.4785$ keV
 $E_{\text{R}} = 1.755939(6) \cdot 10^{-1}$ eV
 $Q_{\text{IC}} = 0.14$
 $\sigma = 3.45 \cdot 10^{-19}$ cm²
 $\mu = 0.935(10)$ nm
 $T_{1/2} = 8.7(3)$ ns
 $W = 0.23(5)$ mm/s

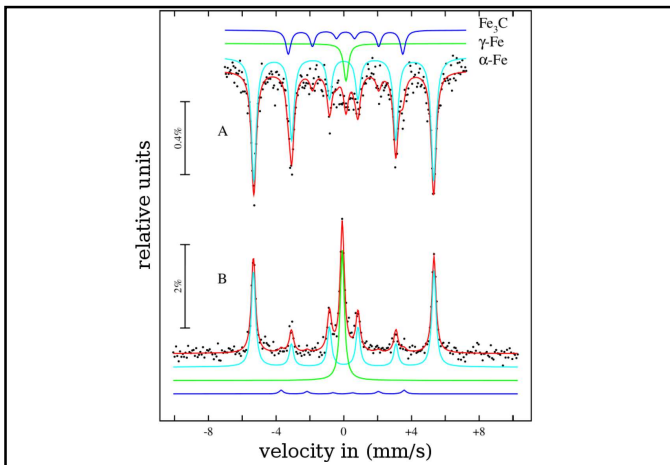
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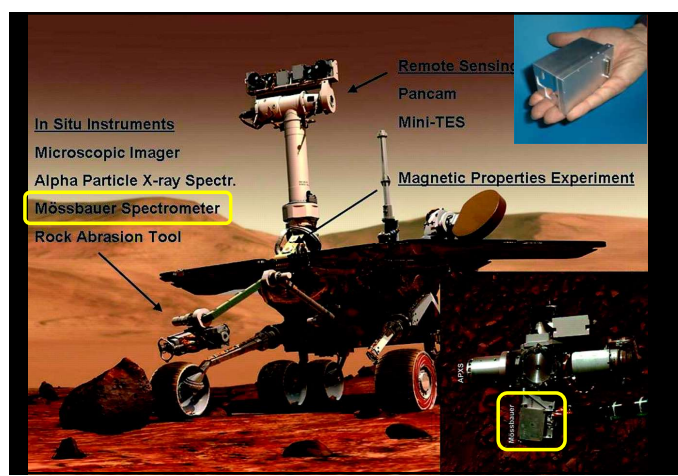
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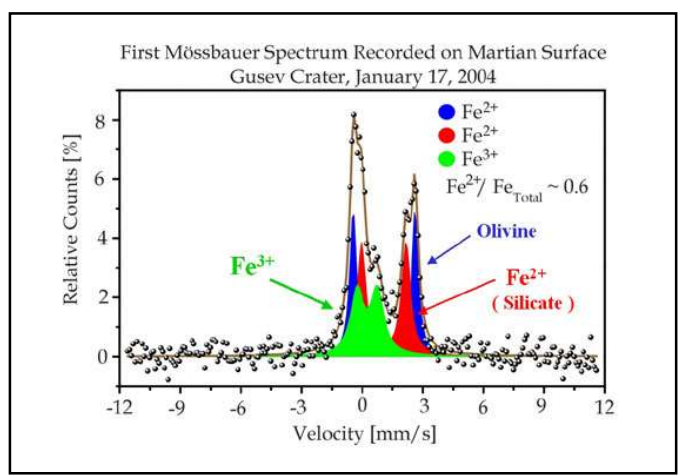
4. Mössbauer on Mars

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