Iron-57 (^{57}Fe)

Iron-57 (Fe-57) is a critical stable isotope for the scientific community. ISOFLEX routinely supplies >95% Fe-57 as metal (foil, discs, powder and ingot) and oxide (Fe_2O_3). At additional cost, we can supply Fe-57 as custom compounds and salts (nitrates, sulfates, etc.). We are ready to offer you the most competitive pricing on your milligram-to-multi-gram Fe-57 needs.

First enriched by Russian centrifuge technology in 1971, Fe-57 has become one of the most frequently used stable isotopes in the world. It is widely used in research to develop successful interventions for anemia, conditions for effective iron absorption and excretion, metabolic tracer studies to identify genetic iron control mechanisms, and energy expenditure studies. Importantly, studies using Fe-57 are critical to determining the movement of various Fe clusters (Fe_4S_2, Fe_4S_4, heme Fe, nonheme mononuclear Fe) in the cell and their "earmarked" roles in the crucial processes of the cell and mitochondria.

The primary research technique undertaken with Fe-57 is Mössbauer spectroscopy, a versatile technique that can be used to provide information in many areas of science such as physics, chemistry, biology and metallurgy. Named after Rudolph Mössbauer, who in 1957 first observed recoilless gamma ray emission and adsorption (since called the "Mössbauer Effect"), it can provide very precise information about the chemical, structural, magnetic and time-dependent properties of a material. For this achievement, Rudolph Mössbauer received the Nobel Prize in Physics in 1961.

Briefly, Mössbauer spectroscopy is resonant gamma-ray spectroscopy, which takes advantage of the extreme resolution of the Mössbauer transition, making it possible to resolve the hyperfine interactions between an atom's nucleus and its environment and providing the link between the chemical state of an atom and its nuclear state. As resonance only occurs when the transition energy of the emitting and absorbing nucleus match exactly, the effect is isotope-specific. The relative number of recoil-free events (and hence the strength of the signal) is strongly dependent upon the gamma-ray energy, and so the Mössbauer effect is only detected in isotopes with very low-lying excited states. Similarly, the resolution is dependent upon the lifetime of the excited state. These two factors limit the number of isotopes that can be used successfully for Mössbauer spectroscopy. Iron-57 has both very low-energy gamma-ray and long-lived excited states, matching both requirements well.

As the recoil and doppler broadening have been eliminated, the limiting resolution factor is the natural linewidth of the excited nuclear state. This is related to the average lifetime of the excited state before it decays by emitting the gamma-ray. Iron-57's linewidth is $5x10^{-9}$ eV. Compared to the Mössbauer gamma-ray energy of 14.4keV, this gives a resolution of 1 in 1012.

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