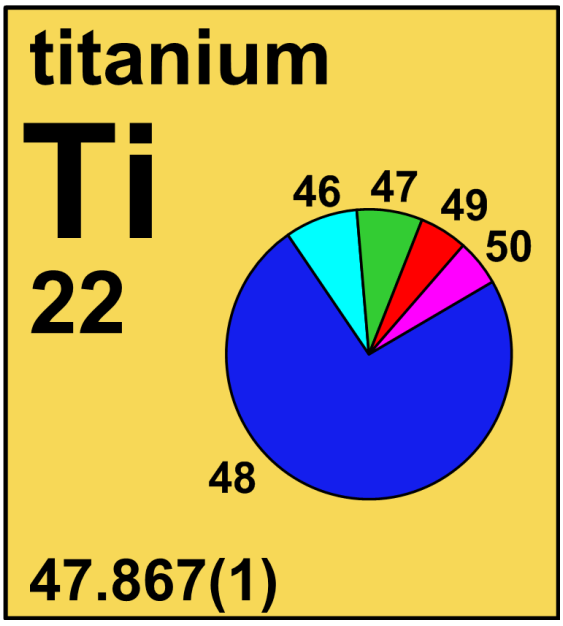
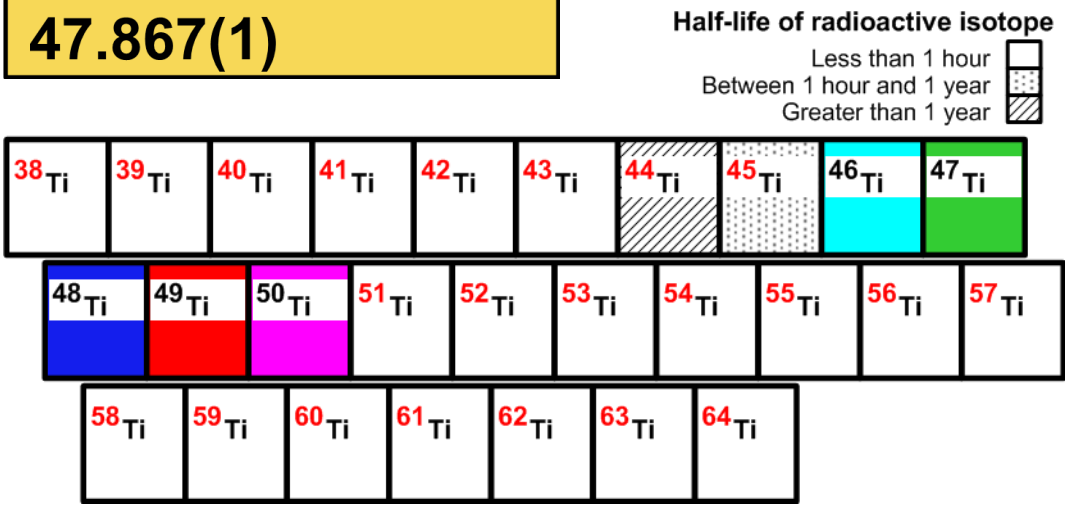
4.22 titanium



Stable isotope	Relative atomic mass	Mole fraction
^{46}Ti	45.952 628	0.0825
^{47}Ti	46.951 759	0.0744
^{48}Ti	47.947 942	0.7372
^{49}Ti	48.947 866	0.0541
^{50}Ti	49.944 787	0.0518



4.22.1 Titanium isotopes in Earth/planetary science

The **isotope-amount ratio** $n(^{50}\text{Ti})/n(^{46}\text{Ti})$ is used to study the early history of the Solar System. The value of the ratio can help determine whether the Solar System was created from a well-homogenized source [194, 195]. For example, variations in titanium **isotopic compositions** of various groups of **meteorites** can be observed (Figure 4.22.1) [196].

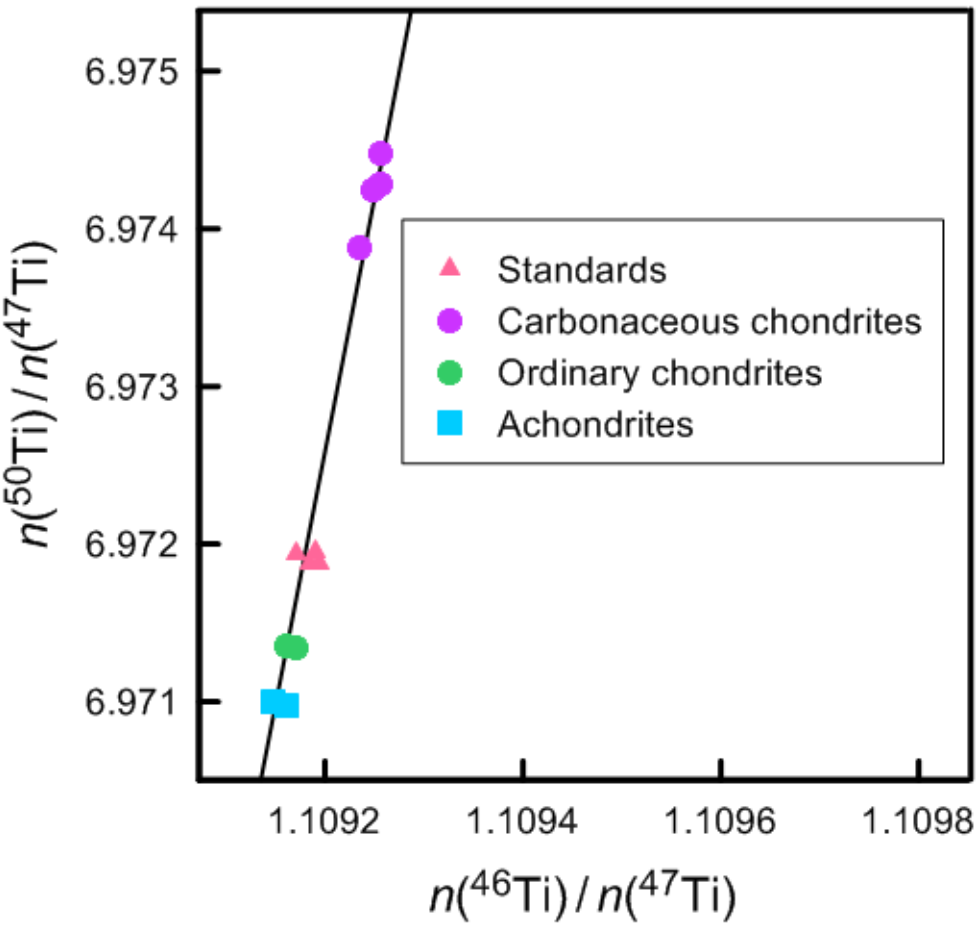


Fig. 4.22.1: Cross plot of the **isotope-amount ratio** $n(^{50}\mathrm{Ti})/n(^{47}\mathrm{Ti})$ and the isotope-amount ratio $n(^{46}\mathrm{Ti})/n(^{47}\mathrm{Ti})$ of selected groups of **meteorites** (modified from [196], assuming measured $n(^{50}\mathrm{Ti})/n(^{47}\mathrm{Ti})$ and $n(^{46}\mathrm{Ti})/n(^{47}\mathrm{Ti})$ isotope-amount ratios of 0.697 19 and 1.109 18, respectively [197]. Normal titanium **isotopic compositions** were observed in standards, but $^{46}\mathrm{Ti}$ and $^{50}\mathrm{Ti}$ **isotope** anomalies were resolved among different meteorite groups.

4.22.2 Titanium isotopes in industry

The isotope-amount ratio $n(^{48}\mathrm{Ti})/n(^{49}\mathrm{Ti})$ has been used in Isotope Ratio Method (IRM) analysis (initial titanium ratio/final titanium ratio) to estimate the energy production of nuclear reactors. This ratio can also be used to confirm that a reactor is being used for non-proliferation purposes (purposes other than to assist in the formation of nuclear weapon grade materials) [198].