

The wonderful thing about TIG rods

...is that some types can be used as low-risk radioactive sources for certain experiments and demonstrations. Here we look at what TIG rods are, how to handle them safely and what uses they can be put to.



Figure 1 - thoriated TIG welding rod, as supplied with the Lascells cloud chamber.

What are TIG rods?

Tungsten Inert Gas (TIG) welding is a form of arc welding. To improve the quality of weld and to make the welding process easier, thorium is sometimes added to the electrode when it is manufactured. A typical thoriated electrode will contain around 2% thorium by mass. The TIG electrode is consumed in the welding process but the material does not form part of the weld. Nevertheless, these electrodes are usually referred to as TIG welding rods.

Thorium is radioactive. A thoriated TIG welding rod will emit alpha, beta and gamma radiation from the thorium and its decay products. The activity of a rod will be around 3 to 7 kBq. Sealed radioactive sources used in schools typically have activities of 70-370 kBq and are designed to emit predominantly one form of radiation.

How do I use them safely (and legally)?

Thoriated TIG welding rods are not subject to much of the legislation that covers radioactive sources in schools. Care must still be taken when using them. Here is some guidance. Please note that were you to weld with a thoriated TIG rod, the control measures would be very different.

- Do not saw, grind or file a thoriated TIG welding rod. These actions will produce small particles containing thorium. The thorium could be inhaled, ingested or could enter the body through a wound.
- Keep the rods in your radioactivity store if you have one and add them to your inventory. If you don't have a radioactivity store, at least ensure they are labelled as "thoriated TIG rods". There is no need to use the ionising radiation warning symbol.

Rods can be handled without protective equipment. The dose rate to a part of the body touching a TIG rod is about four times that of background radiation and it drops rapidly with distance. Clothing will shield you from the alpha radiation. You could walk around with a thoriated TIG welding rod in your pocket for hundreds of hours in a year before receiving the 10 microSievert dose considered to be negligible by the International Commission on Radiological Protection.

What can they be used for?

The electronically-cooled Lascells cloud chamber that SSERC put into each local authority in 2015 [1] uses a thoriated TIG welding rod as a source. As it emits heavily-ionising alpha radiation, it is ideal for producing strongly-visible tracks. If you have an older cloud chamber that came with a radium source, that source should have been disposed of by now. A thoriated TIG welding rod makes an excellent substitute.

If you are running the *National 5 Skills for Work – Laboratory Science* course, you will know that students are required to measure radiation. They cannot use the majority of school sources if there are any under-sixteens in the room. SSERC has suggested using potassium compounds or carrying out the radon balloon experiment. Using thoriated TIG rods is another age-unrestricted activity. With the rod a few mm from the end of our Geiger-Müller tube, we measured a count roughly four times that of background alone.

Finally, it is good to be able to show that some objects happen to be radioactive, not because they require to be but due to the presence of a radioactive substance that has some other useful property. Low sodium salt is one example. It contains potassium chloride, which is mildly radioactive. The radioactivity confers no health benefits but neither does it pose a risk sufficiently large to negate the positive effects of reducing sodium in one's diet by using low salt.

Thorium-free thoriated TIG rods

Cerium oxide or lanthanum can be used as substitutes for thorium in TIG rods. We know of some schools who have bought welding rods marketed as "thoriated", only to find that there is no detectable radiation above background level from the rods. We suggest buying "over the counter" where possible. <<

Reference

- [1] https://www.sserc.org.uk/wp-content/uploads/2015/05/SSERC251_p2.pdf (accessed May 2019).