FIVE QUESTIONS

ON PRODUCING GOLD VIA NUCLEAR FUSION

FOR KARL LACKNER

The U.S. start-up Marathon Fusion aims to produce gold using nuclear fusion. How would that work?

KARL LACKNER: Nuclear fusion generates fast neutrons that can transmute elements, for example, turning a specific mercury isotope into gold. Marathon Fusion plans to use this isotope in the fusion reactor as a neutron multiplier. The context is that the neutrons from fusion are needed to produce tritium – a fuel for nuclear fusion – from lithium, as tritium does not occur naturally. Occasionally, some neutrons are lost, which would break the closed cycle. To prevent this, the reactor can use lead or beryllium to multiply neutrons, meaning one neutron is absorbed and two are released. The mercury isotope has the same property, and the added bonus from this process is that the end product would be gold.

How much gold could be produced this way?

The walls of the plasma chamber would be lined with cassettes containing more than 10,000 tons of a lead-lithium mixture to produce the new fuel. Replacing 500 tons of this with the appropriate mercury isotope could yield around five tons of gold per year in a reactor producing one gigawatt of electricity.

What are the challenges of this approach?

Using mercury as a neutron multiplier is much more complicated, so it probably wouldn't be done in the first generation of fusion reactors. Another fundamental challenge is that the usable isotope makes up only one-tenth of naturally occurring mercury. This means the isotope must be enriched to 90 percent – a technically demanding process. By comparison, uranium for a fission reactor only needs to be enriched to five percent. Even if all the estimated 600,000 tons of mercury in the Earth's crust were used, it would produce only 600 tons of gold per year – just one-fifth of the current global production of around 3,000 tons. Gold would therefore not become worthless, contrary to some media claims.

Is it economically worthwhile?

Yes, because gold is expensive. The five tons of gold from a 1-GW reactor would be worth roughly the same as the electricity the reactor produces. Initially, the process would likely use the 20,000 tons of mercury currently stored as waste, producing about 20 tons of gold per year. However, only a small number of reactors needed for energy generation could be equipped for gold production, due to limited mercury supplies.

Is fusion-produced gold radioactive?

The gold generated in the main process is not radioactive. However, after enrichment, a small fraction of another isotope in the mercury produces radioactive gold. Its half-life is only a few hundred days. At least 18 years should pass before the gold can be worn as jewelry, at which point its radioactivity is comparable to that of a banana. If the gold is stored or used for investment, this is not a major issue. Interestingly, platinum is also produced during the decay process – not something anybody would really complain about either.

Interview: Peter Hergersberg

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ILLUSTRATION: SOPHIE KETTERER FOR MPG