Interview Philipp Walter

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Bert Beyers: Hello Mr Walter, perhaps you could briefly introduce yourself?

Philipp Walter: I am responsible for the Hydrogen Systems business line at Heraeus Precious Metals in Hanau. This involves precious metal applications relating to electrolysis and fuel cell stacks. I am a chemist by training and have held several positions in industry, abroad and in Germany.

What is the purpose of the Hydrogen Systems business line under the Heraeus umbrella?

Heraeus has various operating companies. One of them is Heraeus Precious Metals. And because precious metals are very important in the hydrogen sector, we have decided to introduce a separate business line called Hydrogen Systems from 1 January 2024. This will focus on electrocatalysts and other precious metal applications relating to electrolyser and fuel cell stacks, as well as the recycling of end-of-life stacks and production waste.

What exactly do you do?

The precious metals in question are silver, gold, platinum, palladium, rhodium, ruthenium, iridium and osmium. Some are more important for hydrogen applications than others, for example platinum, iridium and ruthenium. We trade in these precious metals, and we also have products such as electrocatalysts or coatings that are used in stacks. Finally, it is also about the recycling of end-of-life applications or end-of-life materials: how can I separate the precious metal from the various additives and refine it again?

Why are precious metals so important in water electrolysis?

For proton exchange membrane electrolysis - one of several technologies for water electrolysis - iridium and platinum are primarily used. These metals do two things: on the one hand, they conduct electricity and, on the other, they act as catalysts to initiate the reaction that turns water into hydrogen. This does not work with every material. The surface area is particularly important here, which is why less precious metal can be used if the metal is applied to a carrier, "diluted" if you like. The catalysts are applied to both sides of a membrane and serve as a catalytic electrode. When a current is applied, oxygen is produced on one side and hydrogen on the other. Without a catalyst, in this case precious metal, it does not work. Another reason why it has to be precious metals is that the materials have to be very durable, ten years or more in an acidic environment. Only precious metals have such electrochemical properties.

Precious metals - as the name suggests - are particularly valuable. They will therefore be used sparingly. What does that mean in concrete terms?

In English, this is known as thrifting, i.e. the constant reduction of loads because precious metals have a high value. We always say that thrifting is already in the genetic make-up of precious metals, by which we mean that it is quite normal here to use less and less metal in each generation for the same or higher performance. We also see this with electrolysis. When I started working on this - that was in 2018

In the past, iridium loads of between one and 1.5 grams per kilowatt were used. Today, the average is 0.3 to 0.4 grams per kilowatt. Iridium is a particularly expensive and rare precious metal. Heraeus Precious Metals has been able to develop catalysts that result in a reduction of the precious metal loadings so that proton exchange membrane electrolysis can also be set up in the multi-scale gigawatt range. The latest developments even achieve less than 0.1 grams per kilowatt. And the journey is not over yet.

In the future hydrogen world, we will need a lot of electrolysers. Where are the sticking points in scaling up this technology from a resource perspective?

First of all, of course, you need the production capacity to be able to manufacture all these electrolysers. There were many announcements around 2020, hardly a day went by without some news appearing in the press. That has changed a little. In my opinion, we are currently moving away from this hyperscaling and towards normal, highly exponential growth. For precious metals, this means that there is a little less pressure on the boiler in terms of thrifting. This is good, because the more time research has, the better the solution, but there is also a danger in this. The final investment decisions are coming now. Perhaps a little late, but they are coming. Our main concern is not to use standard catalysts from the last ten years, but to use catalysts with reduced amounts of iridium and platinum in order to be more cost-effective and to avoid having to worry about the availability of these critical raw materials in the long term.

From a resource perspective - do you still see a bottleneck for the production of electrolysers?

That depends! Around seven to nine tonnes of iridium are primarily mined each year, mainly in South Africa, 90 percent of which is mined in South Africa. The market is in balance. All the iridium produced is also used. Of these seven to nine tonnes, we think that only 1.5 to two tonnes can go into other, new applications such as PEM electrolysis. These quantities will become available because the other applications will look for other materials, not least for cost reasons, and the use of iridium in these applications will be reduced. This can then be used to and how much electrolysis capacity can be built up per year. Okay. And will that become critical at some point? That depends on whether you use solutions that allow a low loading. Low-load catalysts exist and if you use them, you can assume that there will be no bottlenecks in realistic growth scenarios.

So far we've talked about thrifting, which is an efficiency measure. What about recycling?

This is a huge advantage of precious metals. There has already been an existing recycling infrastructure for decades. What does that mean in concrete terms for an electrolyser stack? It has to be taken apart first, of course. One component is the membrane, which we can process in various ways. In the standard process, you only get the precious metal, with very high recycling rates.

Could you give us a figure?

It always depends on the material. I would say well over 95 per cent for platinum and over 90 per cent for iridium. As I said, it depends very much on the quantity and material. With platinum, even higher recovery rates are possible.

You mentioned iridium earlier, which is particularly resistant to corrosion. And you mentioned South Africa as the main source. This means that there are certain dependencies, and not just for us Europeans, but also for other countries that want to develop this technology. How do you deal with this?

The problem for iridium, for example, is the geological deposit. Even if the EU says I want to have my own mine, this is not possible for iridium because the metal is not available here. From a business perspective, I would make sure that I have appropriate contracts with the relevant countries that guarantee me a supply, for example South Africa. That's exactly what we do at Heraeus Precious Metals. And apart from that, it's about further expanding the recycling of iridium. The problem with iridium is that it is used in relatively small quantities, it is highly diluted in the applications. In addition to electrolysis, there are other applications, such as spark plugs or electrodes for cardiac catheters - and these are milligrams we are talking about here. The effort involved in recycling is of course correspondingly high. And the question is: how can this be done more economically? Are there appropriate political measures to increase the recycling of iridium?

And how do you do that?

For example, Heraeus is leading the way with spark plugs in order to recycle them again and to get possible dependencies under control in the long term. But these processes now have to be painstakingly developed. And that's why it's so important for future applications, such as electrolysis, to think about recycling, and we're doing that with various approaches. It's not just about precious metals, but also about the membrane material, for example. The approach is to think holistically, i.e. circularly rather than linearly.

Does Germany, does Europe need a resource strategy, especially with regard to precious metals and other necessary components for renewable technology?

We already said at the beginning of 2020 that every hydrogen strategy needs a raw materials strategy. When it comes to precious metals - and they play an important role in hydrogen - this naturally applies just as much. What we would like to see is work on this together with the industry and not in private. We have sometimes seen proposals at European level where we have asked ourselves: Why aren't they talking to us? Because we probably understand precious metals better than any institution. That's our core business. Why don't we talk together?

More accurate?

When I look at the European Critical Raw Materials Act, it's a step in the right direction. But all materials are treated equally. In the case of iridium or platinum, it depends a lot on geological deposits. You can't diversify the origin, even if the EU would like to. A quota doesn't help.

And then there is generalised talk about the platinum group metals, whereby there are massive differences between the various metals in terms of availability, costs and what can and cannot be recycled. A recycling infrastructure is absolutely in place for precious metals. We have been doing this for umpteen years. This quota is therefore also completely ineffective; we can fulfil the quota without any problems. In my opinion, the bottom line is that the European Critical Raw Materials Act is strongly orientated towards batteries - and we should perhaps also take a greater interest in other applications.

How satisfied are you with the route?

"Path" means that you start something and are on a journey. And I think I am satisfied that we have embarked on this journey to think about the critical raw materials. Am I satisfied with the outcome, with what has come out, in the precious metals sector at the moment? No.