



# **Capital Markets Day 2022**

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## **Advanced Materials: As a Key Enabling Technology in Various Sectors**

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Thank you, Géraldine. Good morning, everyone here in the room and also those following from home or from the office. Hope you're not too angry. I'm going to tell you more about advanced materials.

First of all, advanced material is actually what we do at Umicore. We start from metal. We use technology to transform them into materials. These materials allow our customers to bring functionalities to their own customers. But at the end of the road, we take them back and we recycle them. So that's what we do. And that's why some of our materials are on Mars and some of our materials will allow you to see in the dark.

### **Foundation of a Circular Materials Technology Company, with Synergies in Mobility Businesses**

Now – and sorry for a busy slide – let me introduce you the magnificent seven, the seven business units that are at the core of what Umicore does. So dealing with metal, more than 30 metals, serving very specific markets, but always with a very strong recycling content. Recycling is nearly always part of the value proposition of these businesses. A few examples, I won't go through the full list.

#### *Cobalt & Specialty Materials.*

They're producing metal chemicals and distributing them to a very diverse group of customers. And actually, they are the origin of the success story of Battery Materials, because back in the 1990s, we were producing metal chemicals that were used to make – that was the very beginning of lithium ion. And then we realised that there was a big opportunity there. And that's where – why we got into battery materials. So this is pretty nice offspring, if you want, from this business, Cobalt & Specialty Materials.

#### *Metal Deposition Solutions*

Now, a totally different business, but also dealing with metal, Metal Deposition Solutions. So precious metals have fantastic properties. I mean, they can – they resist against corrosion. They have fantastic mechanical properties. And that makes them used, for example, in connectors. Problem is that you cannot make a connector full of precious metal. It would be way too expensive. So what Metal Deposition Solutions does is that they put a very tiny amount of precious metal on the surface of some another metal. And this gives the functionalities without the cost.

So think about it every time you plug your cell phone for recharging in the evening or whenever you plug your car. And you will have to plug them hundreds of times, thousands of times, but the functionality needs to remain the same. So that's the value proposition that Metal Deposition Solutions provide to their customers.

#### *Jewellery & Industrial Metals*

Third example, Jewellery & Industrial Metals. I mean, recycling is the basis of what they offer to their customer. They sell products, the recycling service, the value proposition about the recycling of the product is always part of what they offer to their customer. One example, we

make big parts out of platinum, pretty expensive stuff, that are used in refining high-purity glass, so the glass that is used in TV screens and things like that. So the value proposition we make to our customer is something that is going to last longer than what our competitors are supplying.

And when I'm talking longer, we speak about years, more than a year. At plant, refining glass, temperature of 1,500 degrees, the material needs to last for that. But long life does not mean infinite life. So at the end of the day, they also want these metals to be recycled. So that's what we propose to the customer. We are going to sell you something that has fantastic functionalities. And at the end of the day, you will recover the metal which is in it.

So these are three, I think, examples of what these business units are doing.

The icing on the cake is that many of them also play a role in mobility, because if you talk about electronics, if you talk about connectors, they're also in mobility applications.

### **Electro-Optic Materials: State-Of-The-Art Applications in a Sustainable Closed-Loop Model**

#### *Germanium substrates*

Now, maybe jumping in into a specific case, Electro-Optic Materials, which is a business unit, which is actually the one making the product that are on Mars. We make germanium substrates. These germanium substrates are used to make in semiconductor application and mostly to make solar cells. Solar cells that have the highest yields, highest performance, and are therefore mostly used in space application. Most of the satellites circling the earth are using germanium-based solar cells. And the Mars Rover is also using these solar cells. So that's why we are on Mars.

#### *Optical Fibre Cable*

Another application of Electro-Optic materials, just to show you that we can serve sometimes with a very strong leadership position, very different application, optical fibres. When you make optical fibres, you need to start from a very pure germanium tetrachloride. And that's what we make. The recycling is also part of the equation. I remember in my early years at Umicore, I was a young researcher, and we visited a customer. And the customer had a headache, because the yield of the production of the optical fibre was not so good and they were producing quite a lot of scrap. And they were concerned because this scrap was costing them money. They needed to pay someone to get rid of these scraps.

And we figured out that this scrap contained quite a lot of germanium. So we offered them a solution, where not only they could avoid the cost of disposing the scrap, but also recovering part of the germanium. And these days, this customer still buys from us, 20, 25 years later.

#### *IR optics*

The last example is infrared optics, again, a completely different application. You may remember that all these cameras that were scanning of temperature during the COVID times, most of the time use infrared optics which can be made by Umicore. In the future, this is also going to be used in pedestrian detection. More than 50% of the metal used by this business is recycled. So, I mean, it is illustrative, but it gives you an idea of what we do in this advanced material group.

**Key Take-aways: Supporting Our Success As A Circular Materials Technology Company**

So key takeaways for this business unit, big synergy with Umicore. Why? Always about metals and the chemistry around metals. Recycling is always part of it. And very often, we also serve mobility applications.

Technology is key. Customers are buying functionalities. They are really – so we have an application knowledge. We have strong interaction with our customer, because they come to us because we provide this technology.

And very good returns. I mean, these are application where we have a strong leadership position and that translates into good returns. There are growth opportunities in this market. So when they appear and are value creating, we are going to encourage, of course, the business you need to phase them.

**Advanced Materials: Precious Metals Refining - Leadership in Sustainable and Complex Recycling**

Now, let me dip – dive a little bit deeper in precious metals, Precious Metals Refining, which is a big contributor to Umicore results and a very important landmark into our recycling story.

**Agenda**

I will go through two topics. First, explain you a little bit what we do and why we are the world leader in complex and low carbon recycling; but also how we are going to use the RISE pillars to further improve this business.

**Key Enabler of Low Carbon Economy**

Now, first of all, what precious metal refining does is really at the heart of the closed-loop model of Umicore. You can see that there is ore over there so there is mining because mining – you need to start from mining. You need to prime the pump. The metal can only be recycled once they have been put in the system.

So there is always this mining part, which brings the first metal in the application and then needs to be smelted, refined, incorporated in the applications. And here, you can see the three examples, automotive catalyst, battery materials, fuel cells, using these metals. And at the end of life, we bring them back. So there is a true complementarity with our other divisions.

When we interact with our customers on battery materials, the recycling part is really part of the discussion from day one. That's what Mathias explained this morning. And the same is true for fuel cells. The same is true for catalysis. There, too, the icing on the cake is that recycling already today reduces the carbon – the CO<sub>2</sub> footprint of this metal by about 50%. So when people buy metals that are recycled, they save 50% of CO<sub>2</sub> compared to metal that would come from a mine.

**Unique Technology, Touching the Full Value Chain**

Now, looking into more detail in what precious metal refining actually does. So we are recovering 17 metals. We do complex metallurgy. If it is complex, it is for us. So we recover 17 metals out of more than 200 types of complex waste streams. So we are not a smelter

dedicated to one or two or three feeds. We are a smelter which is intrinsically flexible to take these 200 different streams.

So we cover the full value chain. We can go from mines. We can take stuff that are very specific and complex into mine. This is not a major part of what we do, but we can do that as well. But we take a lot of stuff from smelters. We are sometimes defined as the refiners' refiner, because the refineries, when they are copper smelter or lead smelter or zinc smelter, they are really focusing on what they do. They need to be the best in transforming ores and concentrate into metals at the lowest cost possible and achieve the right impurities.

And in the process, sometimes impurities accumulate somewhere, and it's an annoyance. It's something that disturbs their flow sheet. So their metallurgist, they could take them back and put them in the smelter, but it would disturb and actually increase the complexity and the cost on their side. So what we do is that we take that and we process it for them. It's a better value proposition for the smelters than doing it by themselves.

And sometimes we even interact to change their own processes to optimise the full picture, to optimise the ecosystem. So that's something we do on a daily basis with our smelting and refining customers. But we also go deeper down the value chain, to refine – recycle the waste of the manufacturing industry, making the product themselves but also the end-of-life – the consumer end-of-life product, spent automotive catalyst, electronic scrap and things like that.

I think this line that you see here, is very important because it offers a lot of flexibility. So market conditions are changing, metal prices are changing and the products that we process today are not the product that we processed five years ago or 10 years ago. We use this flexibility to always focus on the raw materials that bring the most value to Umicore.

### **Profitable Revenue Model with Significant Metal Price Upside**

#### *Treatment & refining charges*

How do we generate revenue? We have two streams of revenue. On the one hand, our customers – they own their stuff, the raw materials and the metals that are in their raw materials. And so we get paid to extract the metals from these materials. So they pay us, what we call a treatment and refining charge to extract the metal for them, which is more or less determined by the complexity of materials. The more complex they are, the more you need to pay for that.

And this is done with an agreed recovery rate. We cannot recover 100% of the metal present, sometimes in a very dilute form. So typically a customer would come and offer us to process, I don't know, 500 tonnes of something containing a few gram per tonnes of precious metals. So we would process it and reconstitute a contractual restitution of metal; could be 90%, 95% depends on the metal.

This is a commitment we take. Once we have said you are going to get, let's say, 90% of the metal that is in your stuff, we cannot say, 'Sorry guys, but we got only 89%. So the 1% is missing.' No, this is a commitment that we make. On the other hand, if we can get a better recovery than the contractual one, the metal is ours.

### *Metal revenue*

And that's why we have also this second stream of metal – of revenue, which is the metal revenue. Of course, the metal revenue is not come falling from the tree. It is simply because we are better at recovering these metals than the competition. The agreed, the contractual recovery rate is defined by the market. And if we do better than the market, then we can basically get that revenue for ourselves.

So these are the two value drivers, the fixed fee and the value of metal revenue. Needless to say that the value of the metal revenue depends on the metal price and that's why we see a boost when the metal price is high.

## **Very Attractive Market for Umicore: Opportunities with Increasing Complexity of Recycling Feed**

### *Regulatory requirements*

Okay. Why is this a very attractive market for Umicore? It is today, it was yesterday and it's still going to be a very attractive business for Umicore tomorrow. First of all, they are a little bit new. There are very strong regulatory requirements. We were doing recycling already 25 years ago when it was not mandatory, because there was value in the product that we processed, value for customers. But today, it's even mandatory. You need a recycled content in the product. There are – there is societal pressure and societal needs. There is legislation. So this is going to support our business further.

### *Sustainability*

There is the intrinsic sustainability part, which is driven by metal scarcity. I mean, you are reading newspaper, you know that metals are getting scarce. And this is also by the way supporting the price, which also helps more extraction but also more refining. There is this circular economy component and the greenhouse gas footprint that I just mentioned, which is incentivising people to use recycled metals.

### *Economic value*

And last but not least the economic value. There was already an economic value in the past, the metals that are contained in the stuff have a value. And if we can extract that value, it makes sense to recycle them. And this is true regardless of the metal price. Of course, if the metal price would be zero, that would not be attractive, but it's not zero. So, even at the metal price of the past, it was – it did make sense to extract them. And it will make sense again, even if the price normalise in the future.

Something that we have done in our plan, we have not taken any – and Mathias mentioned that – we have not considered the premiums that are going to come for recycled metals. We have considered that the metal prices are going to go back to where they were. There is a likelihood that a market will develop where people want to pay more for recycled metal. But today this market does not exist, this is not yet available, so it's very difficult to quantify. So there is definitely an upside for us, because if at some point in time, people would be ready to pay more for something that comes from recycled content, we would pocket obviously this value. The same if they would pay more for metal containing a lower CO<sub>2</sub> content. But that's not factored in the plans.

**Leadership in Sustainable, Complex and Low Carbon Recycling***Where to play?*

Now where are we going to play? I mean, we are going to do more of what we do well. That's leverage our leadership position in complex low carbon recycling. That's going to remain our focus. That's the focus of precious metal refining I'm talking about. Of course, we're also going to support the new kid on the block that Kurt will develop later, the Battery Recycling Solution. Why? Because this is an adjacent business. This is not the same, but the metals are different. But the key ingredients are the same.

It's all about maximising recoveries, having the lowest cost and the lowest emission. So I mean, that can be transferred; all the logistic issues, the dealing with the complexity of the materials, this is something that we can definitely transfer and support at Battery Recycling Solution.

*How to win?*

And how are we going to win? That's through RISE. You are starting to get used to that I believe.

**Leadership in Sustainable, Complex and Low Carbon Recycling: Sustainable Value Creation for Customers**

Reliable, Hoboken, precious metal – the precious metal refining business unit needs to be as reliable as a bank. And some of you work for banks, so you know what it means. Reliability can come from several factors.

First, our flexibility. We are treating waste and by-products. So the customer does not know for sure what the composition of this waste or by-product is going to be. And if, from one day to the other, the composition is slightly changing, we are not sending them back home and saying, 'Sorry, I can't process it anymore because you have added that impurity that I cannot process anymore,' which is very typical for other players on the market. No. We tell them, 'Look, let's look at it and let's try to solve that problem together.' So this is really something that our customer value a lot.

Trust. There is a lot of value in what our customer entrusted us with. Sampling is always an issue because I mentioned before, sometimes it's 500 tonnes of materials that they have on their hands with a few grams per tonne of precious metals. So there is a lot of value, but it's difficult to define how much it is. So we are a world leader in sampling heterogeneous complex feed. Our customer can witness but they also trust our ability to make a representative sample of a very large amount of materials. So that's something very valued by our customers.

Reliability. We are entrusted with big value of precious metals. We need a few weeks or months to process them. The customer wants to make sure that they will get back their metal at the end of the road. So that's the bank side of it. We are talking about millions, tens of millions, hundreds of millions of value. So that's something where you want a partner which is really reliable.

And the last one is a bit new, is this enablement through – to reduce the CO<sub>2</sub> footprint of our customer so they will be able to count on us. Mathias mentioned that for the OEMs and for the battery materials. This is also somewhat true for other metals.

**Leadership in Sustainable, Complex and Low Carbon Recycling: Innovative Metallurgy and Chemistry**

Now, innovation. I think it's fair to say that we are mining – we used to be a mining company. We came into materials through the metals, so we have a long experience in refining and – recycling and refining methods. So we have what you call the pyro and hydro expertise, which is needed, and I will come to that later on. So we are going to keep this innovation and technology.

You can come every single day at the large plant in Hoboken. There are teams of PhD in metallurgy, PhD in chemistry, improving the processes. Debottlenecking something, adjusting a process to a new feed, changing completely break – making a breakthrough process to do something in a different way, in a more efficient way. So that's something we do. We are – we will keep doing that, of course.

What is new is that we are going to use this technology as well to develop – to solve the CO<sub>2</sub> reduction – to achieve the CO<sub>2</sub> reduction journey that Géraldine just described.

*Leverage our unrivalled pyro and hydro expertise*

First, on this expertise. I mean, you can't convert – refine 17 metals and convert very complex and low grade materials into metal in one step. You need many, many steps. And the two main categories of processes that you have at your disposal when you're a metallurgist is the pyro, which is a smelting process, high temperature process; and the hydro, which is more putting the metal into solution and using these categories.

So, at Hoboken, half of the processes are pyro, half of the processes are hydro. I think this is not always well known, because we always see ourselves as a smelter, and we see the big smelting furnace. There is quite a lot of hydro processes. So why do we do combination? Because they all have their specific advantages. If you think about pyro, you have a very high rate of reaction so you can do a lot of stuff very fast. You have a very large robustness to impurities because you have this averaging effect of the smelting. The physical footprint is actually lower. Because if you can – if you have a high rate of reaction, you can do a lot of stuff in a very limited space.

If you do hydro, the metals are often very diluted in solution and you need huge farms of, let's say, equipment to process it. So on the other hand, hydro has a very big advantage in terms of selectivity. So by combining the two, you get the best of both worlds. This is what we do on a daily basis in Hoboken. And actually, this is also what Kurt will propose to do later on.

*'Next Gen' technology to reach our decarbonisation goals*

Looking at decarbonisation goals, you have been seen this avoiding emissions, let's say, tool in Géraldine's presentation. This is actually something that we do for quite some time already, by using the synergies between the feed. Some of the feed that we put in the smelter in Hoboken have heat content, so they create heat when you process them. Some of them consume heat. You put them together, you don't need a fuel, and you get the best efficiency. So that is something that we have been doing for cost reason for a lot of time. But it's also going to be very helpful in reducing the energy consumption and hence the CO<sub>2</sub>.



The second one, when we cannot avoid them is to replace. Replacing, let's say, fossil fuel by electricity looks straightforward. In our case, sometimes the fuel, the fossil fuel is also reagent. So it's a bit more complex than simply replacing a heat source. It's also – but we are going to do it and we have good R&D people to find out how this can be done.

And the last one is capturing the greenhouse gas. Géraldine mentioned the nitrous oxide capture that we do in Hoboken. Of course, the right investment will be required. I mean, we have – we are going – we want to be a net-zero so we are going to do it. Again, this should, on the long-term, translate into margins and premium.

### **Leadership in Sustainable, Complex and Low Carbon Recycling: Key partner for the Circular Economy**

Now let's look at the S, maximising the closed-loop benefit. The smelter is 25 years old and has always done this. So we have a majority of our input mix coming from secondary sources and we have this very much embedded also, the responsible sourcing is part of Umicore DNA. So we will keep doing that. We also know that urban mining is not straightforward. I mean, you need to deal with the coexistence with the neighbouring communities so we don't spare any effort to improve continuously on that.

#### *Maximising closed-loop benefits*

So, on the first part, already more than 90% of our PGM metals are coming from secondary sources. So that's what we do at the smelter. You have all the range of certification that we have. And as Géraldine mentioned, we are already saving huge amount of greenhouse gas just by doing more recycling compared to primary extraction.

#### *Sustainable co-existence with our neighbours*

If you think about sustainable coexistence with neighbours, what are we doing? We are, first of all, minimising impact. That's the real red line that what we need to do. Using best available technology, for example, full encapsulation of our lead refinery. Our lead refinery is a huge building. It is put under negative pressure, so that no single dust can escape the building without being processed. So that's something we have been doing a few years ago.

Smart logistics. We actually steering our logistic activities depending on the weather conditions. So if the weather is not favourable, we avoid doing stuff that could generate emissions. And we also have real-time measurement, not only of the quantity of dust emitted, but also the composition of the dust. You can see that this reduction has been a fact and we have achieved significant reduction between 2015 and 2021.

We're not going to stop there. But move over something that we have been – announced and doing is the creation of a buffer zone between our plant, which you see at the right side – by the way, you see this lead refinery, which is fully encapsulated in grey. So we have already a one hectare green zone on our site. We are creating a five-hectare green zone. And the purpose is to create a buffer between the industrial activity and the residential activity on the on the left side.

### **Leadership in sustainable, complex and low carbon recycling: Strong focus on Operational Excellence**

And then excellence. We have an industrial operation, so operational excellence is not something new for the people. They are doing it, but we need somewhat to put the turbo on that. Mathias mentioned about the logistics. Logistics is a big part because we have these

200 categories of materials but if you multiply that by the number of suppliers, we handle a lot of stuff on the – in the plant. So we are going the extra mile in terms of digitalisation, automation to reduce significantly, reducing the breakeven points, reducing costs, increasing efficiency. So I think this is pretty straightforward.

#### *Continuous debottlenecking and value creation*

Something we do as well, and which has a very strong lever, a very strong leverage is debottlenecking. And I will give you an example. This is, on the left side, what we have done between 2010 and 2018 in terms of material processed input to the plant, to the furnace. We had already increased compared to the design capacity – the plant was built at the end of last century, quite some time ago. But, let's say, 90 in – between 2000 and 2010, we had already multiplied the capacity by – increased by 80%.

So the design capacity, what we did in 2010 was already 80% higher than the design capacity, because of better methodologies, like engineering, better refractories, I mean, technical levers. And between 2010 and 2018, we have increased by another 50%. So all in all, it's nearly multiply by three between the design capacity and what we achieved in 2018.

So you would ask me, but why did you then suddenly do badly in 2019, 2020 and 2021. Something happened in 2019. The precious metal price started to increase a lot. And then we made a trade-off between value and volume. And we decided that it was much more profitable for Umicore to process very complex stuff containing a lot of precious metals at the cost of a little bit of volume, but creating a lot more value. This is the kind of flexibility that we use in Hoboken. We are driven by value; we are not driven by volume. But of course, if you can get the volume, you get all the benefit in terms of cost. We can always go back to the 2018 situation in case the market situation would require it.

#### **RISE: Leadership in Sustainable, Complex and Low Carbon Recycling**

Now, let me summarise how RISE is going to help us. I give you all the elements. So we don't change the business model. RISE is going to help us to get better. So what we will get is sustainable returns and very strong cash flows, even at normalised PGM price. They are in the plan and PMR continues to deliver outstanding return on capital employed and very strong cash flow.

And as I mentioned it before, there is an upside potential, first of all, if the metal price would be higher than what we have put in the plan, but also if there are premiums associated with more recycled or low CO<sub>2</sub> content. There can also be both, because probably the recycled demand and the low CO<sub>2</sub> will have also a positive impact on the metal price. But that's – in the plan we've been pretty conservative and even being conservative, we generate quite a lot of value.

Thank you. This is – and yeah, last but not least, putting some figures on it. So what we mean by providing strong cash flow and good value is EBITDA margins getting close to 40% and guaranteeing 20% return on capital employed even by 2030, when the metal price are going to be back to very historical level. We have been doing more, but 20% is something that we can sustain.

Thank you for your attention.