2023 EU Restriction of PFAS

IPA submission to the consultation

Summary

- The International Platinum Group Metals Association urges the Commission to adopt a proportionate approach to the regulation of PFAS that delivers the intended benefits without undermining the EU's own strategic, policy and environmental ambitions by unnecessarily disrupting critical industry applications of fluoropolymers – where there are no suitable alternatives – in circumstances where the toxicity and risk to workers, and the environmental emissions both in use and at end-of-life, are expected to be negligible to zero.
- Platinum Group Metals (PGM) are categorised as critical raw materials, important to the EU's strategic ambitions
- PGM provide a critical function within PEM electrolysers and fuel cells that are the basis of the hydrogen economy, and their unique properties have for many years been utilised in numerous other important applications providing enormous health and societal benefits, including anticancer drugs, medical devices such as pacemakers and cochlear implants, catalytic converters that prevent the emission of harmful chemicals from vehicle exhausts, electronic equipment, jet engines, and fertilizer production.
- The International Platinum Group Metals Association (IPA) supports the ambition to prevent highly persistent and toxic chemicals from entering the environment, and also supports the recognition that the benefits of taking a particular course of regulatory action must be weighed against the negative consequences of that action.
- The Restriction proposal insufficiently considers essential uses of PFAS, especially industrial uses of solid polymeric forms of PFAS with negligible environmental emission potential. Such fluoropolymers, which are non-soluble, non-mobile, non-bioavailable, and non-toxic already present a much-reduced concern compared to non-polymeric PFAS. Such circumstances of essential use, low hazard and expected zero environmental release potential must be differentiated from those where there is a bona fide risk commensurate with Restriction.
- Certain classes of fluoropolymer (fluoroelastomer and fluoroplastic) captured under the current Restriction proposal are essential to the refining and recycling of PGM. They are used within items such as seals, gaskets and coatings within industrial processing equipment (reactors, pipe work, etc) because their unique properties can withstand the extremely harsh conditions necessary within PGM refining, thereby maintaining the integrity of the equipment and ensuring the hazardous contents remain contained. The quantities of these fluoropolymers are modest and contained; environmental emissions from their use within PGM processing equipment are expected to be zero. And at their end-of-life, it is common for the fluoropolymer components that have been used within PGM processing equipment to themselves be put through the refining process to recover any adsorbed PGM. This will result in thermal degradation and mineralisation of the fluoropolymer.
- Fluoropolymers have been used in PGM processing equipment for decades, in some applications replacing asbestos – which infamously is a carcinogen and banned in the EU. Glass equipment may theoretically be used in certain applications, but this would present a more significant safety hazard, and even then seals and other components would still need to be made from fluoropolymers. There are no known alternatives that can impart the required properties and survive the extremely aggressive conditions involved in PGM refining and recycling.

- It is vital that regulation not only recognises as essential uses of PFAS within end products such as PEM electrolysers and fuel cells, but also critical uses of PFAS within the upstream manufacturing supply chain of those products; otherwise, the manufacture of products critical to the EU's environmental health and sustainability ambitions and energy transition will be forced to relocate outside of the EU, causing substantial economic harm to the bloc, and causing the EU to become entirely dependent on import. This would present a serious supply reliability risk, contradicting the EU's own Critical Raw Materials objectives, while serving negligible environmental benefit.
- Recent research provides evidence that the unique catalytic properties of PGM may actually be part of the solution to remediating PFAS contamination of the environment. The study concluded that palladium-based catalytic reduction may be broadly applicable to the ambient-temperature destruction of PFAS compounds.
- It is important that a proportionate approach to the regulation of PFAS is adopted that delivers the intended benefits without unnecessarily disrupting critical industry applications of fluoropolymers in circumstances where the toxicity and risk to workers, and the environmental emissions both in use and at end-of-life, are expected to be negligible to zero. In those cases, the use of fluoropolymer spare parts as well as within newly manufactured processing equipment should be permitted to continue for an unlimited period and be exempt from the Restriction.

The IPA

The International Platinum Group Metals Association (IPA) is a non-profit association that represents the worldwide leading mining, production and fabrication companies in the global platinum group metals industry. The Platinum Group Metals (PGM) are platinum, palladium, rhodium, iridium, ruthenium and osmium.

PGM are Critical Raw Materials that support the EU Green Deal

PGM are critical enabling materials for the EU Green Deal, fundamental to the hydrogen economy through catalysing both hydrogen production in PEM electrolysers and hydrogen use in fuel cells. PGM were part of the first Critical Raw Materials (CRM) list published by the EU in 2011 (European Commission, 2011), were included in each iteration since (European Commission, 2014, 2017, 2020), and are included in both the list of strategic raw materials and the list of critical raw materials within the 2023 Regulation proposal (European Commission, 2023a). PGM are significantly above the thresholds for both high economic importance and supply risk, reflecting the high economic value of associated products, low potential for substitution and high import reliance (European Commission, 2023b).

In the EU Critical Raw Materials Act (CRMA) proposal, the EU Commission has proposed 2030 targets for the minerals required for its green transition to be mined, processed and recycled in Europe: 10% of annual raw materials mined in Europe, 40% processed in Europe, and 15% recycled in Europe. Europe should also not be dependent on a single third country for more than 65% of any critical raw material. There are indications targets for processing and recycling in the EU may be increased to 50% and 20% respectively.

Virtually all the world's natural PGM resources are outside of Europe. There is some very minor primary production of PGM as a by-product of mining other minerals within Europe, accounting for less than 1% of global supply (European Commission, 2020b, 2023b). Over 99% of the PGM in use in the EU originated outside Europe – predominantly South Africa (which has by far the greatest PGM mineral reserves), Russia, Zimbabwe, Canada, and the USA. Europe does, though, play a critical role in the PGM supply chain. PGM are infinitely recyclable and perfectly suited for the circular economy. Europe is the largest recycler of PGM (Eftec 2023). In 2022, for example, 40% of the global recycling of platinum was done in Western Europe (WPIC, 2023). It has been estimated that recycling end-of-life autocatalysts delivers more than 57% of the European supply of PGM (Yakoumis et al, 2021).

The strategic importance of PGM to the EU's objectives was repeated in the recently published European Commission Joint Research Centre report 'Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study' (Carrara et al, 2023). For example, in relation to the hydrogen economy, the report notes, *inter alia*:

- platinum is *"the indispensable raw material for the catalyst layer for PEMFC* [Proton Exchange Membrane fuel Cells]";
- "*Despite the targets set to decarbonise the transportation sector, through switching to hydrogen-fuelled FC cars, the demand for platinum will remain high*";
- "*An increase in EU fuel cell manufacturing capacity requires a growth in the capacity to supply processed materials and subcomponents*";
- "*Enhancing the recycling of PGMs can reduce supply risks at the refining stage*."
- "*there are key materials for a particular technology, such as platinum group metals (mainly iridium and platinum), titanium for PEM electrolysers*"
- "*closed-loop recycling of spent autocatalysts to recover materials such as platinum is a well-established practice, and these flows could be channelled into the electrolyser industry*."

PGM industry in Europe

The precious nature and industrial importance of PGM is a consequence of great value and catalytic activity from very little material. In Europe, manufacture and import of PGM amounts to around 400 tonnes per year, but with uses in a wide array of applications and industries, including *inter alia* aerospace and defence, automotive emissions control, electronics and electrical equipment, hydrogen production, hydrogen fuel cells, fertilizer manufacture, anticancer drugs, medical devices, jewellery and investment, the value chain for PGM in Europe (excluding complex end products) has been estimated at approximately €95 billion (Eftec, 2023).

Fluoropolymers are critical to the refining and recycling of PGM

PGM are noble metals, i.e. very stable and unreactive. The refining and recycling of PGM therefore requires use of extremely aggressive thermal and chemical (acidic and oxidising) conditions. Certain classes of fluoropolymer (fluoroelastomer and fluoroplastic) captured under the current Restriction proposal are essential to the refining and recycling of PGM. They are used within items such as seals, gaskets and coatings within industrial processing equipment (reactors, pipe work, etc) because their unique properties can withstand the extremely harsh conditions necessary within PGM refining, thereby maintaining the integrity of the equipment and ensuring the hazardous contents remain contained. The fluoropolymers used in such components used within PGM refining and recycling include PFA (perfluoroalkoxy alkanes), PVDF (polyvinylidene fluoride), ECTFE (ethylenechlorotrifluoroethylene / Halar), PTFE (polytetrafluoroethylene), FKM (Fluorine Kautschuk Material / Viton), and FFKM (Kalrez). These fluoropolymers are chemically stable, non-soluble, non-mobile, non-bioavailable, and non-toxic, and are considered as 'polymers of low concern' based on OECD criteria (Henry et al, 2018; Korzeniowski et al, 2022).

Environmental emission of PFAS from PGM refining and recycling are negligible to zero

The quantities of these fluoropolymers used in PGM refining and recycling are modest and they are contained within and are a critical part of the PGM processing equipment. They are solid materials specifically intended to cope with the aggressive chemical conditions of PGM refining; hence, loss in use is negligible and likely zero. It is typical for such components to be replaced after around 20-25 years and even after that time the components are fully intact with no indication of any degradation. And due to the valuable nature of PGM, it is common for the fluoropolymer components used in PGM refining at their end-of-life to themselves be put through the refining process to recover any adsorbed PGM. This can be expected to result in the complete thermal degradation and mineralisation of the fluoropolymers. Temperatures of over 900 °C and in most cases over 1,100 °C are utilised for a prolonged period within the pyrometallurgical process of PGM refining. Moreover, Best Available Techniques (BAT) for waste incineration in Europe, often supported by regulation, require that air treatment systems where halogens are present (as is the case in PGM refining) ensure a temperature of 1,100 °C for at least 2 seconds followed by several treatment steps to clean the air. Whereas, it has for example been demonstrated that the fluoropolymer PTFE is thermally degraded to carbon dioxide and hydrogen fluoride at normal waste incineration conditions of 870 °C for 4 seconds or 1020 °C for 2.7 seconds (Aleksandrov et al, 2019). There was no evidence of release of a variety of smaller, non-polymer PFAS that were specifically analysed (Aleksandrov et al, 2019). A laboratory-scale study also showed that under normal municipal waste incineration conditions fluorotelomer-based polymers are degraded without releasing PFOA (Taylor et al, 2014).

Availability of Alternatives

No viable alternatives to the use of fluoropolymers in the described applications within PGM processing equipment are known. These polymeric PFAS have been used in PGM processing equipment for decades, in some applications replacing asbestos – which infamously is a known carcinogen banned in the EU. Glass equipment may theoretically be used in certain other applications, but this would present a more significant safety hazard, and moreover even then seals and other components would still need to be made from fluoropolymers. There are no known alternatives that can impart the required properties and survive the extremely aggressive conditions involved in PGM refining and recycling. An absence of these system components would have a severe impact on the functionality, safety, and service life of PGM industrial processing equipment.

PFAS within PGM recycling feedstocks

The PGM industry is a pioneer of the circular economy and has for many decades been recycling PGM-containing products to extract, conserve, and reuse the precious metal contents. Recycling feedstocks may comprise a variety of product types such as end-of-life automotive catalytic converters and electronic equipment. PGM recycling feedstocks may contain PFAS. Although expected to be at a low level, the actual PFAS content of feedstock streams are not measured and not known. The feedstocks are heterogeneous and a representative sample for analysis can only be taken after the feedstock has been homogenised which includes thermal treatment – which will destroy any PFAS that may have been present. The recycling feedstocks are considered 'waste' and as such fall outside the scope of the proposed EU Restriction. And any PFAS present will be destroyed as the feedstock progresses through the PGM refining process. It is vital though that any future regulatory developments to embed the circular economy and invigorate the hydrogen economy and use of PGM within electrolysers and fuel cells do not inadvertently alter the status of PGM recycling feedstocks and inhibit the continued success story of PGM recycling. The recycling of PGMs is not only an exemplar of the circular economy, a number of European sectors and products that use PGM would not be economically viable or financially competitive with the rest of the world if they were required to use virgin precious metal; the business model for widespread applications from nitric acid and fertilizer production to hydrogen fuel cells are dependent on recycling of PGMs.

PGM may help remediate PFAS environmental contamination

Not only does the use of fluoropolymers in the recycling and refining of PGM not contribute to the environmental burden of small, soluble, hazardous PFAS substances, recent research provides evidence that PGM may have the rare capability to offer a realistic potential to remediate environmental contamination by PFAS. A US research collaboration (Long et al, 2021a; Long et al, 2021b) demonstrated that H_2-based membrane catalyst-film reactors coated with palladium nanoparticles catalysed the hydrodefluorination of PFOA (perfluorooctanoic acid, one of the most prevalent PFAS in the environment). Continuous-flow tests achieved stable long-term depletion of PFOA to below the EPA health advisory level (70 ng/L) for up to 70 days without catalyst loss or deactivation. The researchers conclude that their results document "*a sustainable catalytic method for the detoxification of PFOA-contaminated water*" (Long et al, 2021b), and that palladium-based catalytic reduction "*may be broadly applicable to the ambient-temperature destruction of other PFAS compounds*" (Long et al, 2021a).

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