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Applications of iridium for satellites and in other high technology areas

Thorsten Döhring [1], Anne-Catherine Probst [1], Manfred Stollenwerk [1], Rene Hudec [2]

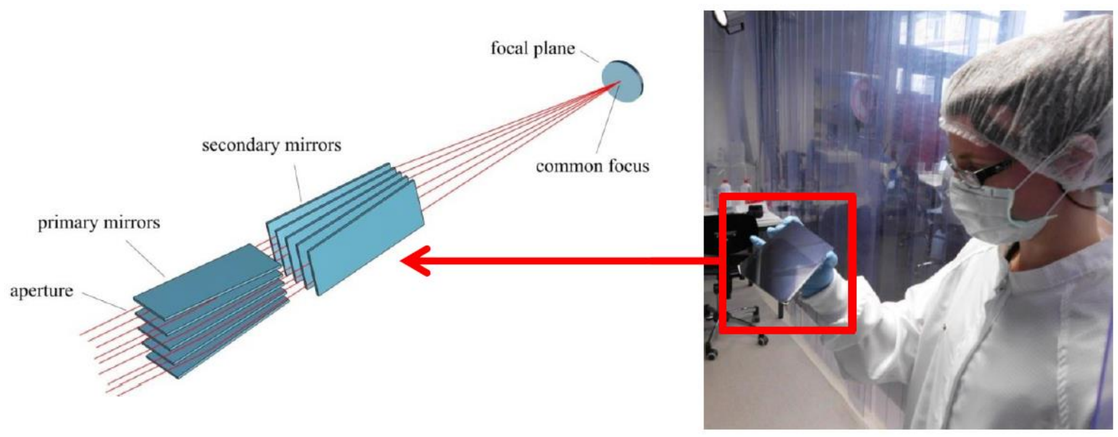
[1] Aschaffenburg University of Applied Sciences, D-63743 Aschaffenburg

[2] Czech Technical University in Prague, CZ-16627 Prague 6, Czech Republic

Summary

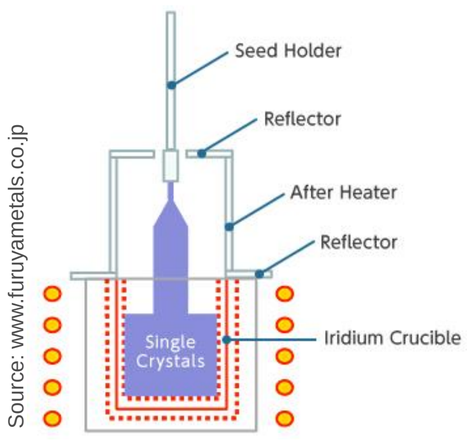
Due to its unique physical and chemical properties the rare noble metal iridium is enabling fascinating applications for satellites and in other high technology areas. For example: The coating laboratory at Aschaffenburg University of Applied Sciences is sputtering thin iridium reflection layers for space-based astronomical X-ray mirrors and iridium coatings as diffusion barrier for hydrogen isotopes in sophisticated scientific experiments. Background on different applications of iridium and on some experimental realizations is presented in this contribution.

Mirror coatings for space-based X-ray telescopes

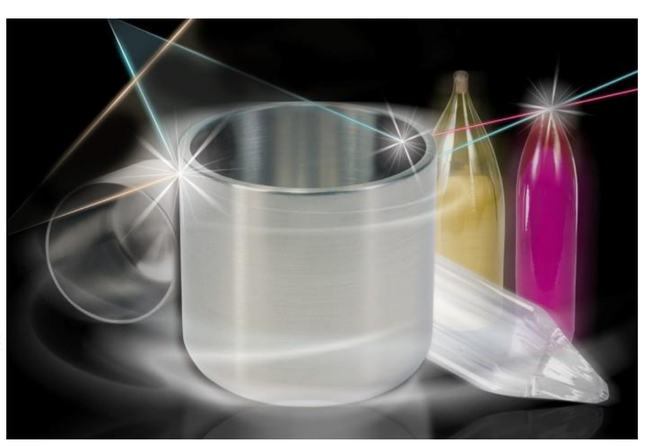


Iridium coatings promise excellent reflectivity properties in the X-ray range. Together with its international partners the coating laboratory at Aschaffenburg University is developing thin iridium reflection layers for space-based astronomical X-ray mirrors. [1] [2]

Iridium crucibles for single crystal growing



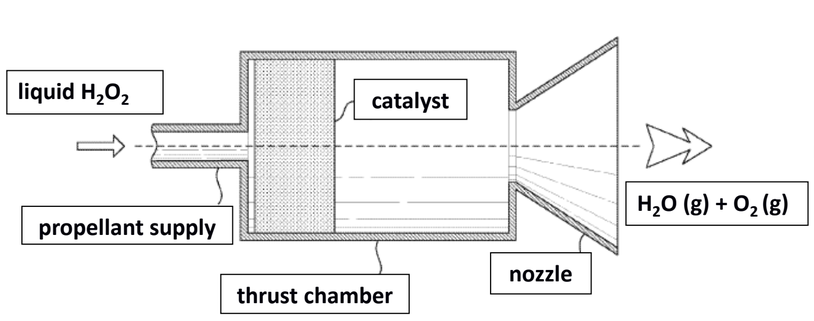
Source: www.furuyametals.co.jp



Source: www.heraeus.com

Only non-alloyed, very pure materials such as platinum, iridium and gold can be used for growing single crystals from oxide melts. The melting temperature, the atmosphere and the constituents of the melt determine the choice of material. Iridium crucibles are used at temperatures up to approximately 2300° C for growing crystals of high melting oxides for laser technology and the optical industry. [3]

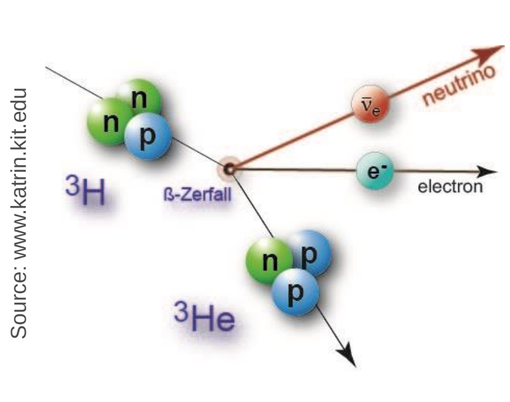
Iridium as catalyst material for space propulsion



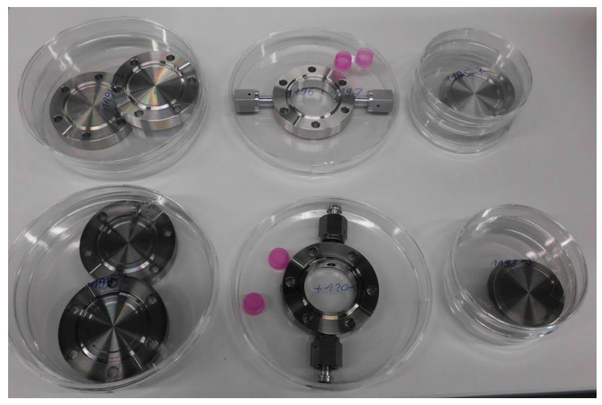
Source: www.elementalmicroanalysis.com

In the previous decades space propulsion mainly rely on highly toxic and carcinogenic fuels like hydrazine. Although such propellants have a long heritage and excellent properties, the effort for their safe handling is complex and very expensive. Alternative fuels like hydrogen peroxide (H_2O_2) would provide less critical and more environmentally friendly technical solutions [4]. For the decomposition of H_2O_2 metallic catalysts are needed. In this context Aschaffenburg University and its partner, the German Aerospace Center (DLR), are developing new iridium based catalytic materials for satellite thrusters.

Tritium diffusion barrier in neutrino experiments



Source: www.katrin.kit.edu



Neutrinos are the lightest particles in the Universe and their tiny mass is a clear indication for physics beyond the standard model of elementary particle physics. The KArlsruhe TRItium Neutrino (KATRIN) experiment will investigate the most important open issue in neutrino physics: What is the absolute mass scale of neutrinos? Tritium with its suitable lifetime of 12.3 years is the premium candidate for such experiment. For the precision measurement of the neutrino mass the tritium diffusion into the vacuum chambers walls is a disturbing factor. Aschaffenburg University has coated vacuum flanges with iridium layers for tritium diffusion barrier experiments. [5]

Nuclear battery cladding for the Cassini probe

Source: https://saturn.jpl.nasa.gov

Source: www.energy.gov

The Cassini space probe was launched in 1997 to explore Saturn and its moons. Solar panels couldn't power Cassini at Saturn, which is about 1.4 billion kilometers away from sun. Batteries and chemical fuel cells wouldn't have kept the probe operating 20 years. So NASA built Cassini around the radioactive isotope plutonium-238. Pu-238 emits alpha particles as it decays, and that alpha radiation can raise temperatures to more than 1,250 degrees Celsius. Radioisotope thermoelectric generators (RTGs) convert a small percentage of this heat into electricity. The plutonium is sealed inside shells made of iridium. The three RTGs on Cassini have provided the spacecraft with a steady electrical power supply of nearly 900 watts. [6]

Acknowledgement

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References

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