



Rhodium-Coated Mirrors for harsh environments and high-performance optical systems

Optical diagnostic systems are essential to monitor and control plasma performance in fusion environments such as ITER. Within these systems, plasma-facing “first mirrors” play a critical role in transmitting accurate optical signals from the tokamak to external diagnostic instruments. These components must withstand extreme conditions including radiation, deposition, and corrosion while maintaining high optical performance over time.

Polyteknik AS, in collaboration with F4E and ITER, has developed advanced rhodium coating solutions specifically tailored to these demanding requirements.

The technology

Polyteknik provides high-performance rhodium coatings applied to full-scale first mirror prototypes used in ITER’s optical diagnostics. The coatings are applied using magnetron sputtering technology, enabling:

- Precise control of coating thickness and uniformity
- Deposition on complex geometries, including curved mirror surfaces
- Low surface roughness to preserve optical performance
- High crystallinity to minimise corrosion and degradation over time
- Very high coating thickness compared to regular mirrors, for compatibility with plasma self-cleaning technologies.

Advantages and Potential Applications

Polyteknik’s solution addresses key challenges associated with plasma-facing mirrors:

- Resistance to erosion, deposition, and oxidation
- Preservation of reflectivity under neutron and particle flux
- Compatibility with in-situ cleaning systems and long operational lifetimes

Beyond fusion, this technology can be relevant for other applications requiring high-reflectivity and durable mirror coatings under demanding operating conditions.

Polyteknik’s expertise includes the deposition of stable coatings with different materials and thicknesses, including relatively thick layers that maintain optical performance over time, as well as standard mirror coatings. These capabilities could be of interest for other big science facilities, advanced diagnostic systems, and optical components operating in harsh or high-vacuum environments.

Collaboration opportunities

[Polyteknik](#) offers this advanced rhodium coating, and other customized PVD coatings, to companies and research institutions developing optical components for demanding environments. Polyteknik is prepared to provide coated components, assess the suitability of the technology for new applications, and collaborate on projects to adapt and validate the solution for specific industrial or scientific applications.

Fusion for Energy Technology Transfer Programme

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