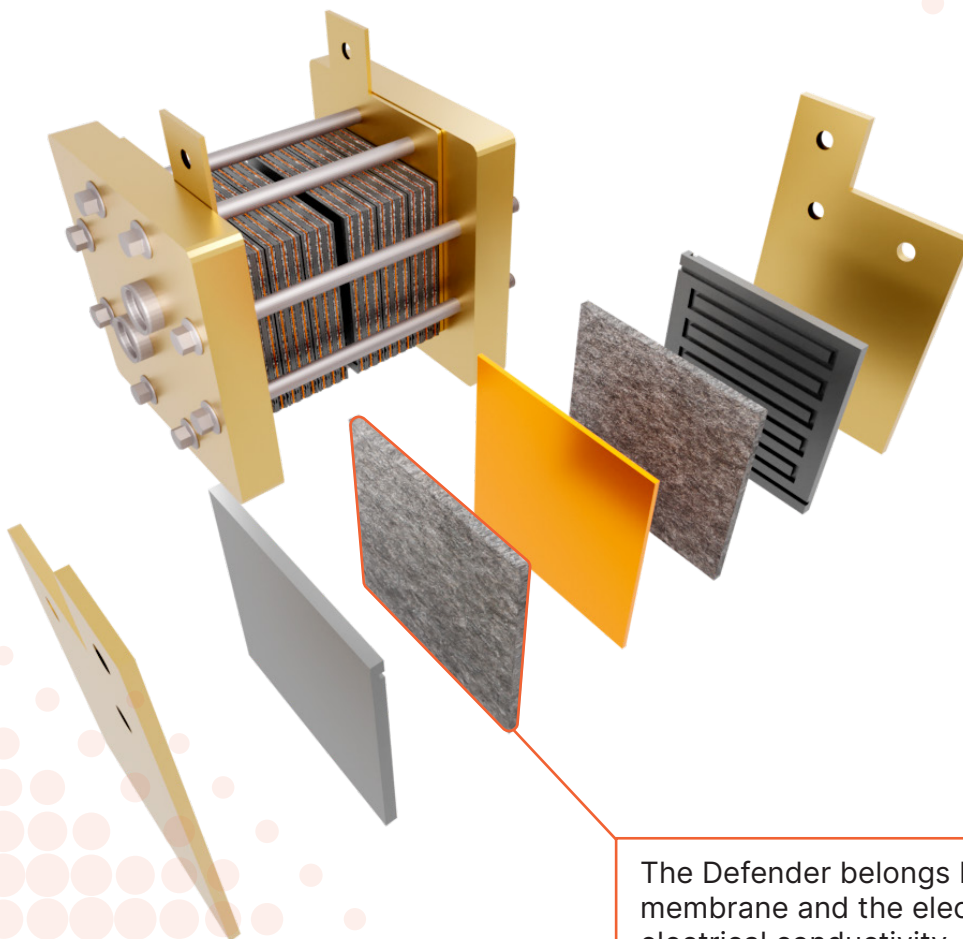


# Calicat DEFENDER<sup>®</sup>

Increase the performance and extend the life of your electrolyser cells.



The Defender belongs between the membrane and the electrode to increase electrical conductivity, protect the system from catalyst dissolution, reduce gas cross-over and prevent corrosion.



Increased durability under aggressive, intermittent power



Lower energy consumption, higher conductivity, higher catalyst utilization



Recombination catalyst reduces the risk of gas crossover

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## Overview

Calicat Defender is a protective catalyst coating on the anode porous transport layer (PTL) that reduces cell and stack electrical losses and is a defense against deteriorating catalyst coated membranes. The Defender increases electrical conductivity and provides co-catalysis when input power is very high. As the membrane thins and gas cross-over rises, Defender recombines the gases safely to extend operating life and reduce total cost of produced hydrogen.

## Key Benefits



### Increased Efficiency and Lifetime in Aggressive Conditions

At elevated current density ( $>3A/cm^2$ ). Defender immediately improves total efficiency by more than 3%. After 10,000 hours of high stress operation paired with renewable energy input cycles and ramped down to truly zero power, Defender remains in place to extend life.



### Make the most of your Low-Iridium CCM's

Calicat Defender applied to the porous transport layer adds long-lived conductivity and enables improved durability and utilization in low-Iridium environments. The Defender enables manufacturers to reduce Iridium content without sacrificing performance.

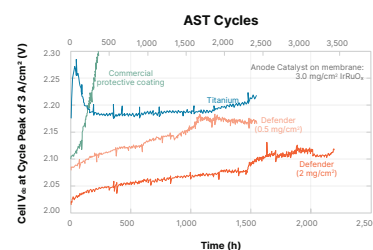


### Protect your equipment from early failure

Power swings from renewable energy sources can destroy traditional electrocatalysts and membranes at the nano, micro and meso scale. Calicat Defender incorporates a special catalyst to eliminate the dangers of internally mixing oxygen and hydrogen gases by instantly and safely recombining the gases. With less than 0.5% cross-over during thousands of hours in aggressive duty cycles, the Defender is a life extender and cost reduction component available in 2024. When the primary Iridium catalyst dies, cells with Defender installed continue to operate safely at reduced efficiency inherent to the longest life catalysts.

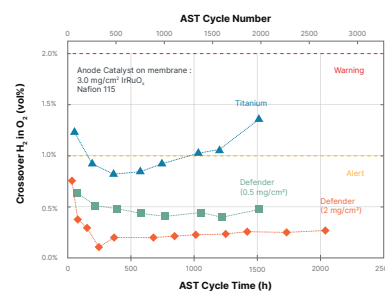
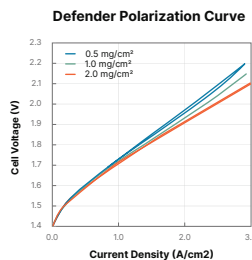
## Reliable and Durable

Defender reduces resistance, lowering cell voltages, and has been repeatedly demonstrated to last for thousands of hours in Accelerated Stress Testing.



## Improved Performance vs Industry Standards

Defender demonstrates greater efficiency and durability with variable power inputs than industry standards. Every electrolyser can benefit from the Defender.



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