

SUPIRCAT™ INTERNAL REFORMING CATALYSTS FOR SOLID OXIDE FUEL CELLS APPLICATIONS

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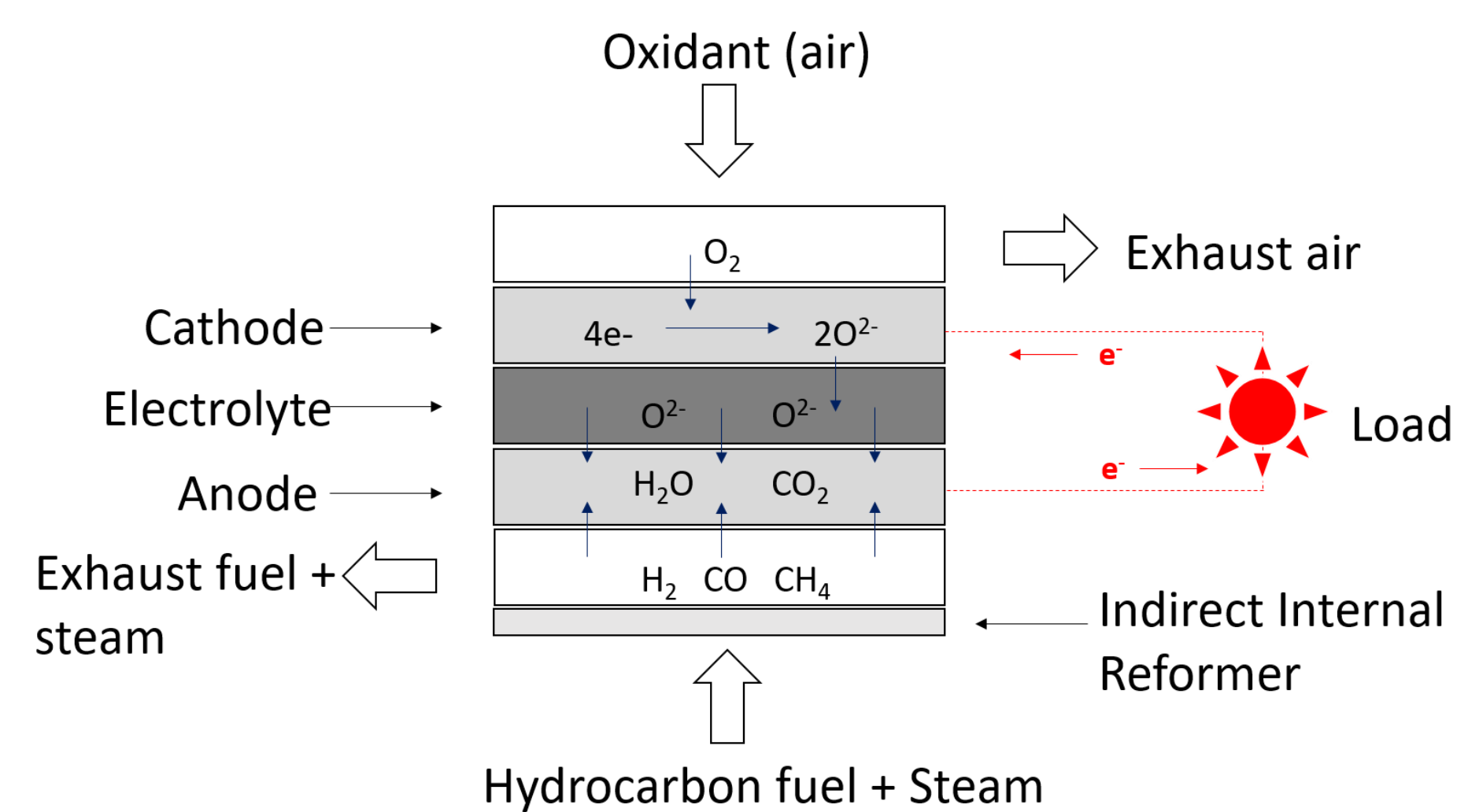


Abstract

Nexceris has developed a family of steam reforming catalysts (*SupirCat™*), geared towards internal reforming in Solid Oxide Fuel Cells (SOFC) applications. *SupirCat™* catalysts immediately achieve equilibrium conversion when heated to reaction temperature and do not require a pre-reaction activation step for activation. This allows SOFC developers to integrate a high performing internal reforming catalyst into their systems without the operational costs and manufacturing complexity associated with pre-reducing the stack. *SupirCat™*'s activity has been examined with particular attention to factors such as coke formation (encountered in low S/C feedstocks), sulfur tolerance (encountered in typical natural gas feedstocks), and thermal cycling. *SupirCat™*'s performance under these conditions has shown that if operated in typical SOFC regimes, the performance will not be affected. *SupirCat™*'s performance has been probed both in pellet form as well as a coating on pre-aluminized stainless-steel plates with exemplary performance in both cases.

Indirect Internal Reforming SOFC

Schematic diagram of an internal reforming SOFC

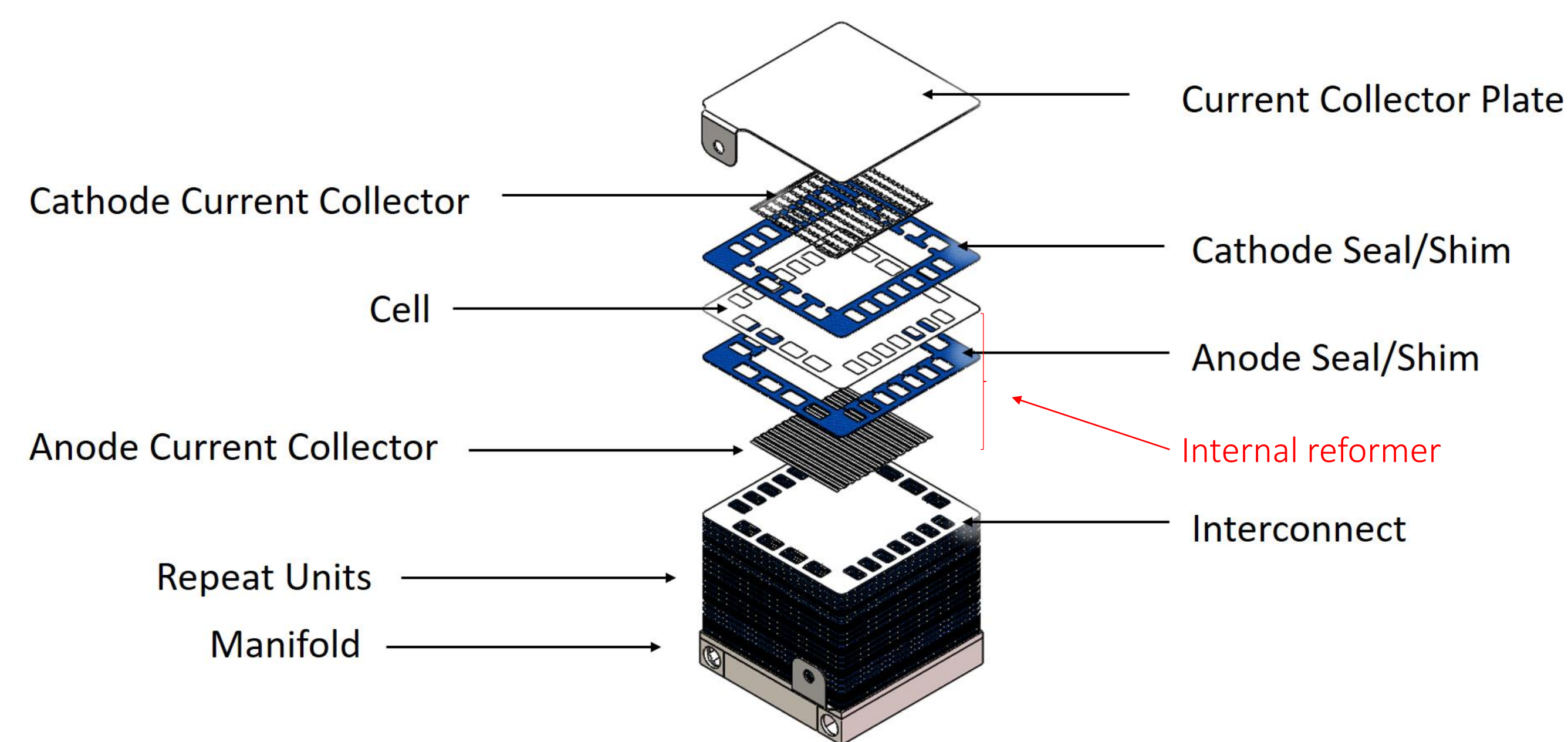


Internal reforming is attractive to SOFC developers because it presents a route to eliminate the thermal stresses on the SOFC components resulting from the heat generated from electrochemical reactions.

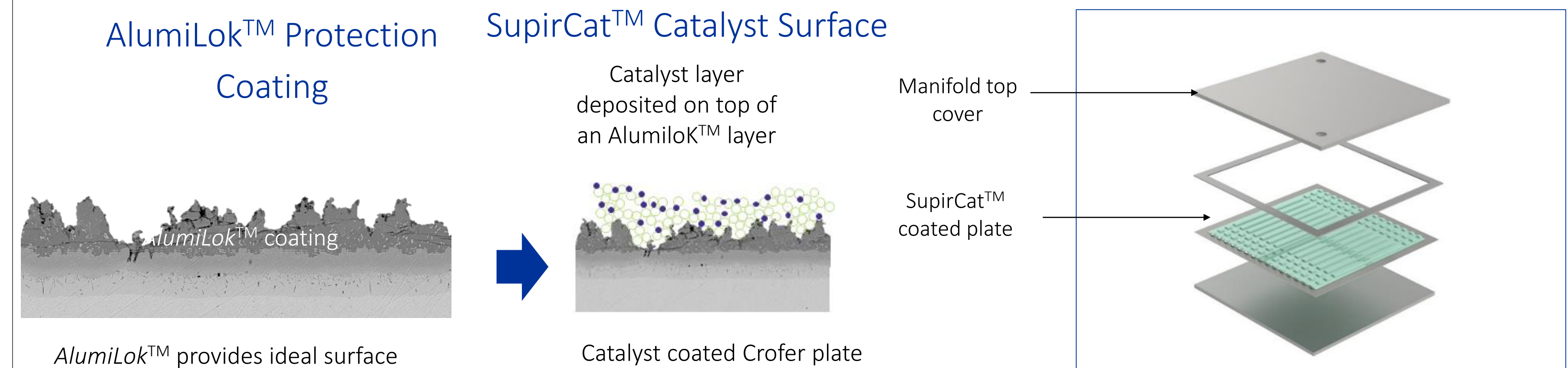
In external reformers, this heat has to be removed by some means e.g. rapidly blowing air on the cathode side

In internal reformers, the endothermic reforming reaction utilizes this heat and as such relieves the cell from the thermal stresses. This increases SOFC stacks shelf life.

Schematic diagram of Nexceris' proprietary SOFC stack [1]



AlumiLok™ "Primer" for SupirCat™

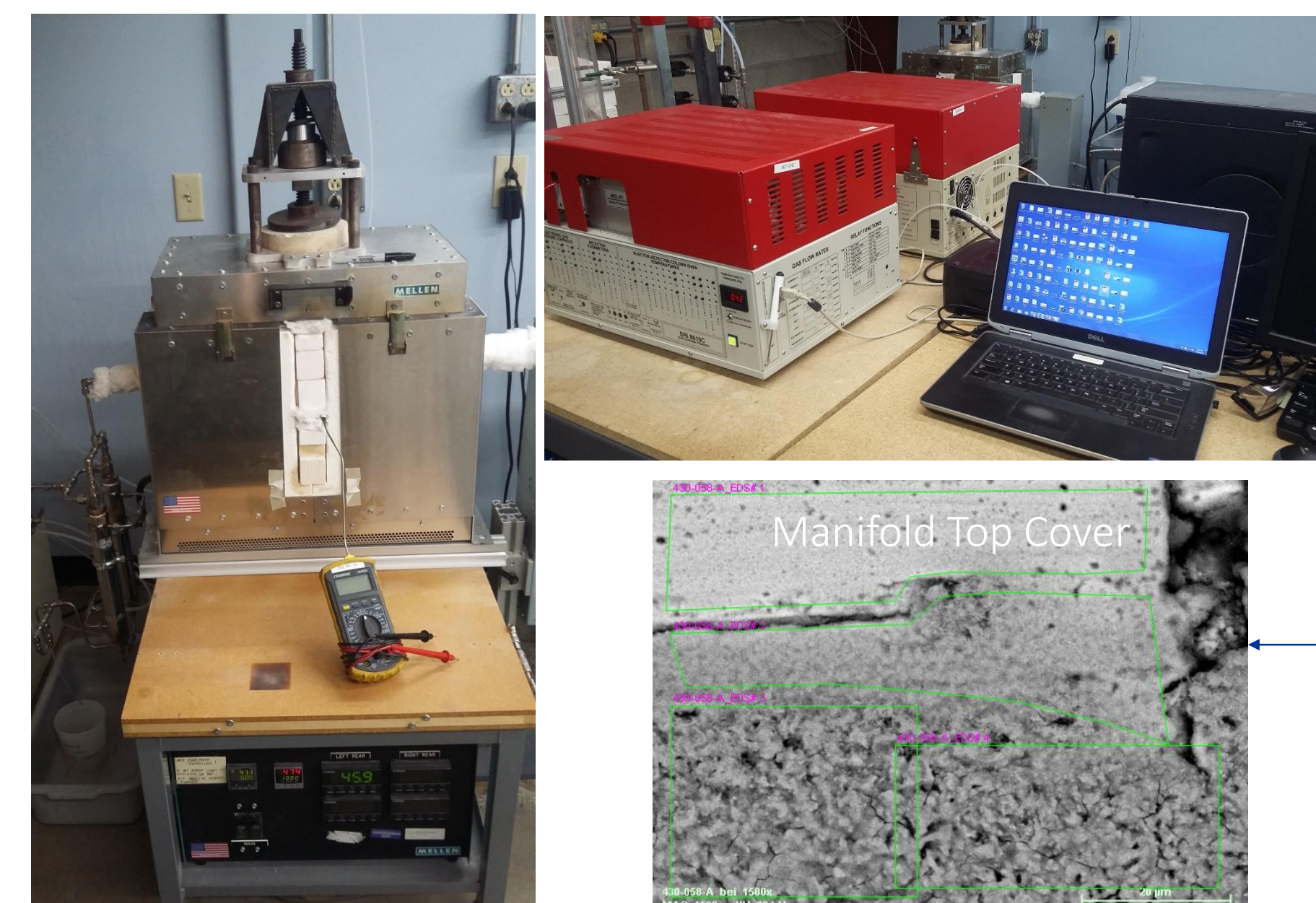


AlumiLok™ provides ideal surface

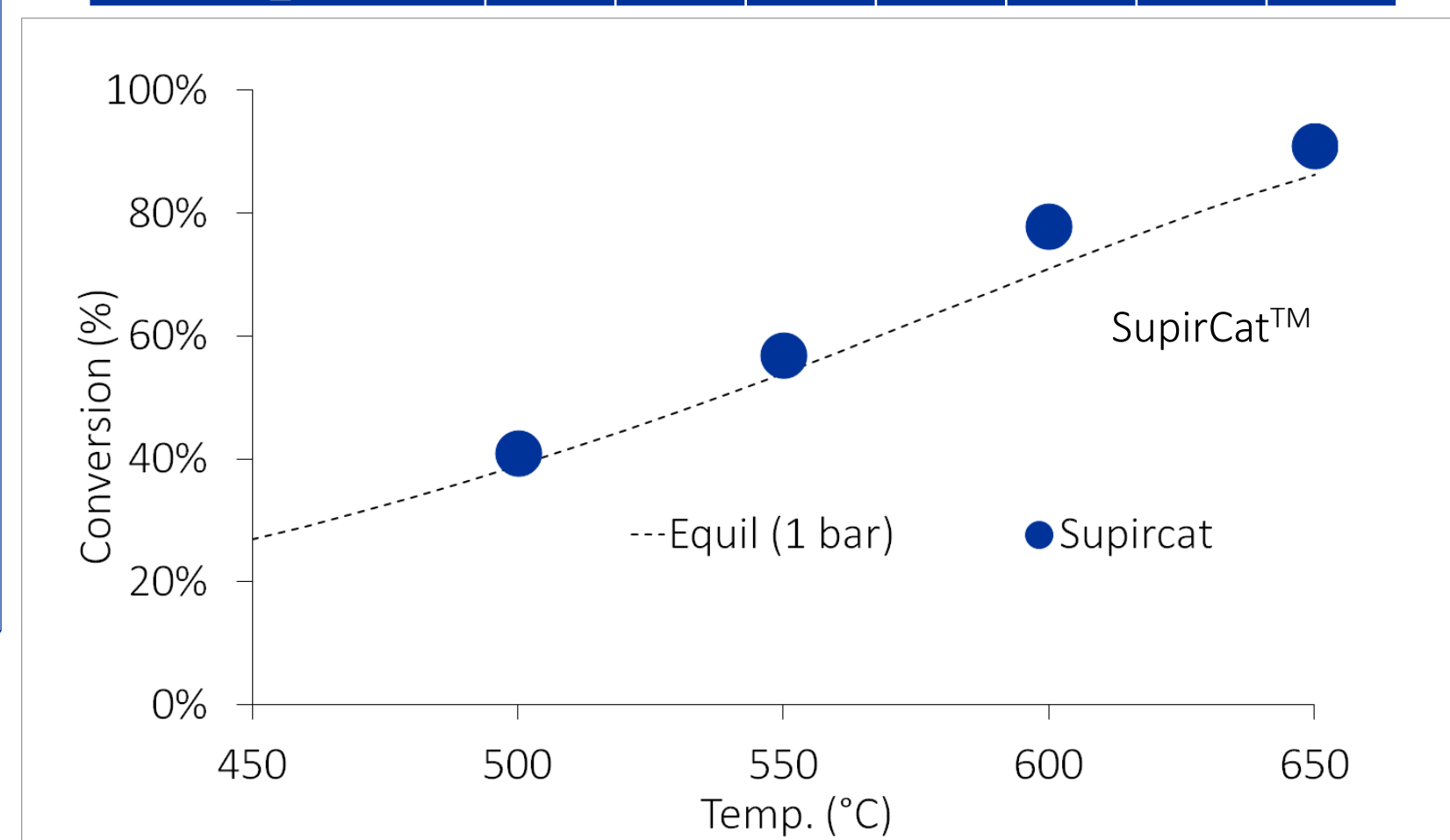
Catalyst coated Crofer plate

- Nexceris' simple heat-treating aluminization slurry coating technology (*AlumiLok™*) creates coatings tailored for the SOFC market uses [2]
- This coating is exploited to act as "anchor" sites for the deposition of an active catalyst layer (*SupirCat™*) that can be implemented as an indirect internal reforming component.

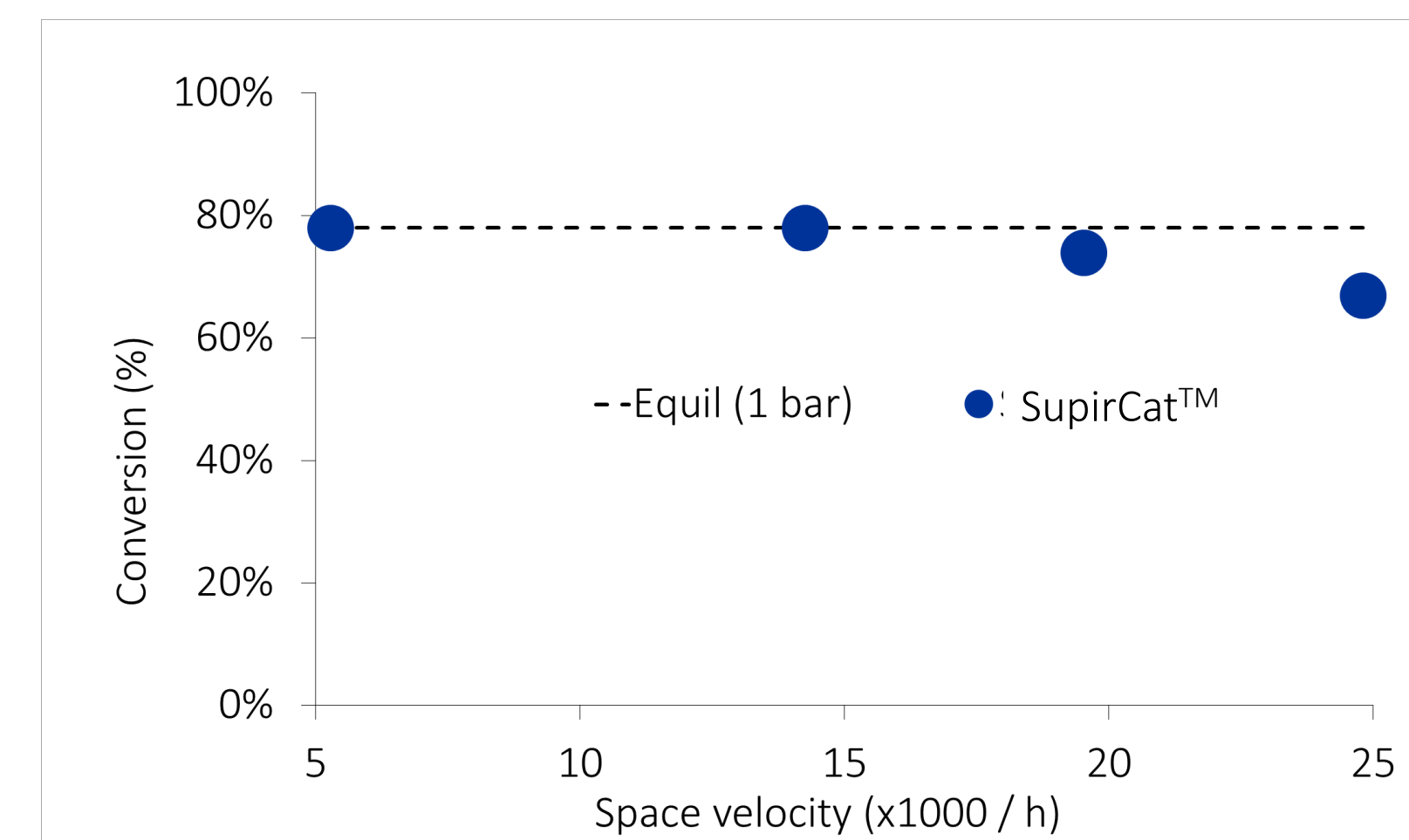
Pictorial representation of Catalyst Test System



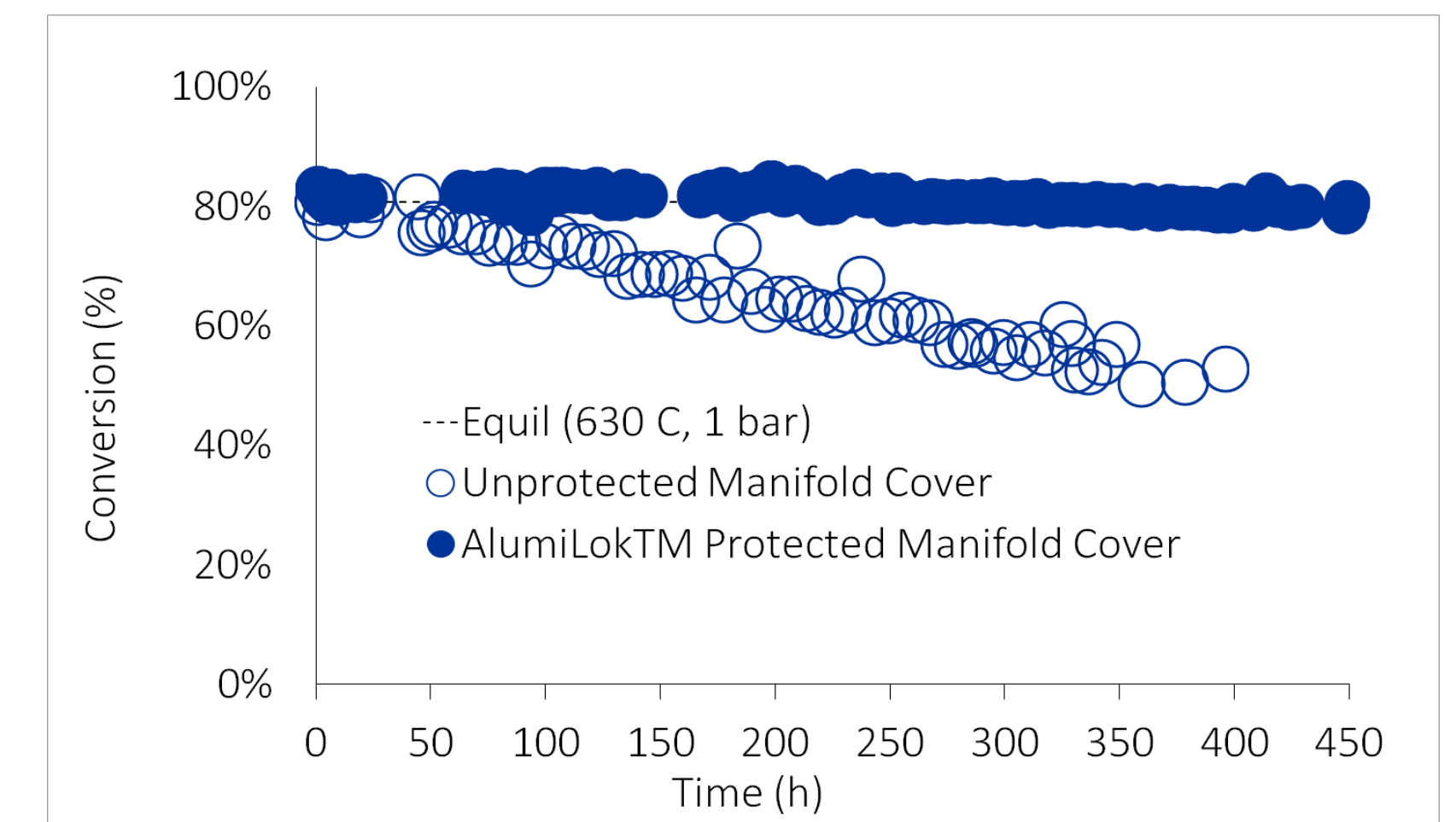
Spectrum	O	Al	Si	Cr	Mn	Fe	Zr
430-058-A_EDS# 1	20.2	0.2	0.1	23.7	1.6	53.8	0.5
430-058-A_EDS# 2	34.1	<0.05	0.1	21.3	1.1	43.2	0.2
430-058-A_EDS# 3	37.2	0.1	0.1	12.6	0.6	49.2	0.3
430-058-A_EDS# 4	29.7	<0.05	0.1	12.7	0.7	56.7	0.1



Conditions: Space velocity – 5,000h⁻¹, S/C = 2.5, Pressure – 1 bar



Conditions: Temperature – 600 °C, Pressure – 1 bar, S/C – 2.5



Conditions: Space velocity – 5,000h⁻¹, S/C = 2.5, Temp. – 630 °C, Pressure – 1 bar

REFERENCES

- Day, J.M., Swartz, S. L., Arkenberg, G. B., Sellers, T. C., U.S Patent 8,968,956 B2
 - Choi, J. P., Weil K. S., US Patent, 2010/0297341 A1
- Please contact Chris Corwin at (614) 842-6606 ext. 128 or c.corwin@nexceris.com to discuss how this proven process can work best for your company or organization.

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