

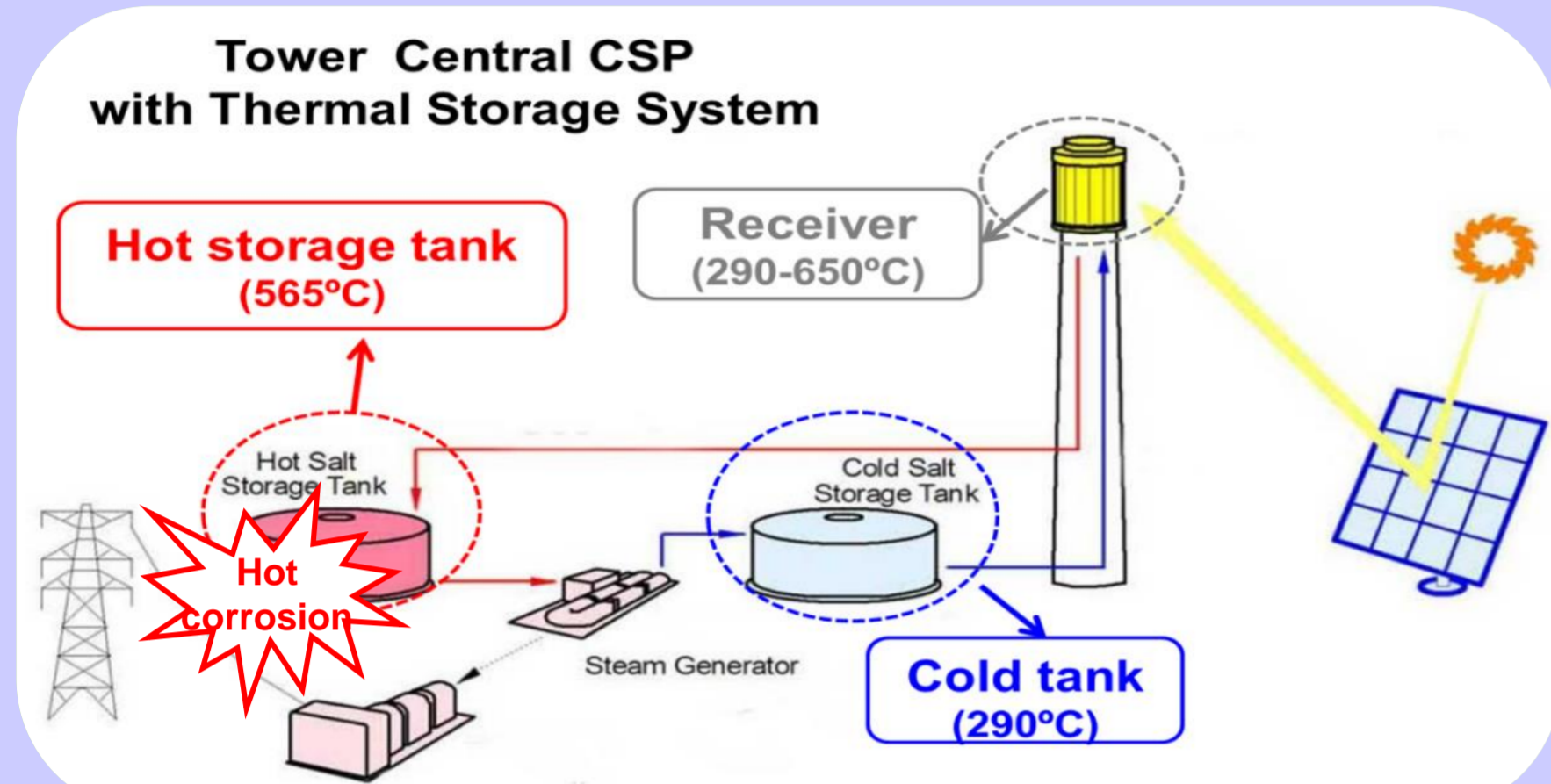


Corrosion Resistant Coatings for Concentrated Solar Power

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BACKGROUND

- An important advantage of concentrated solar power (CSP) is the use of thermal storage extending production of electricity during day and night
- Molten salts are preferred storage materials, however they introduce hot corrosion in component systems

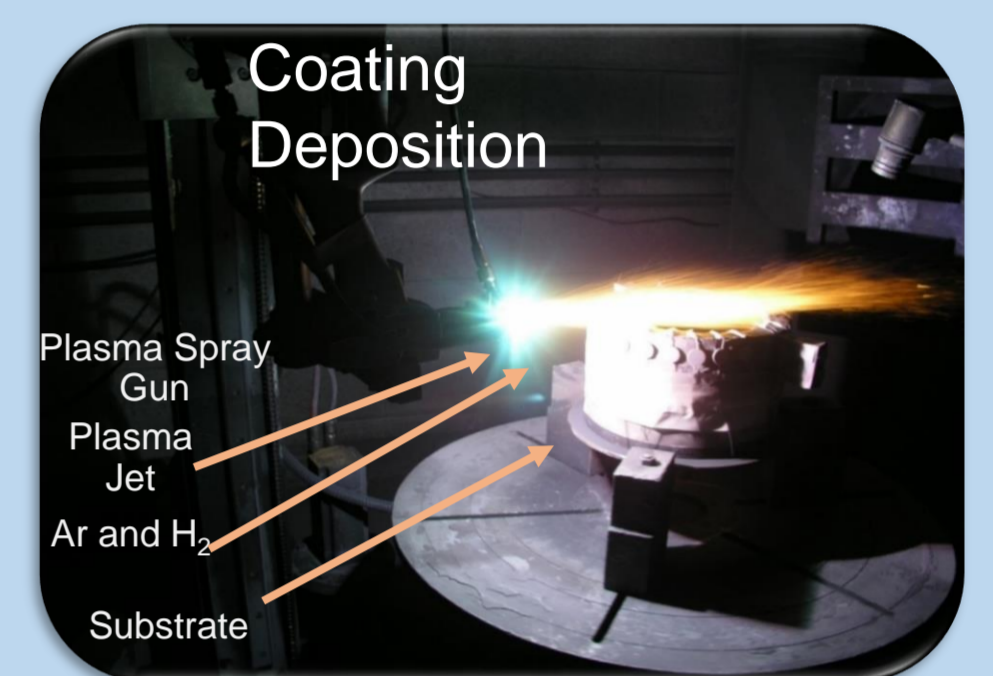


AIMS AND OBJECTIVES

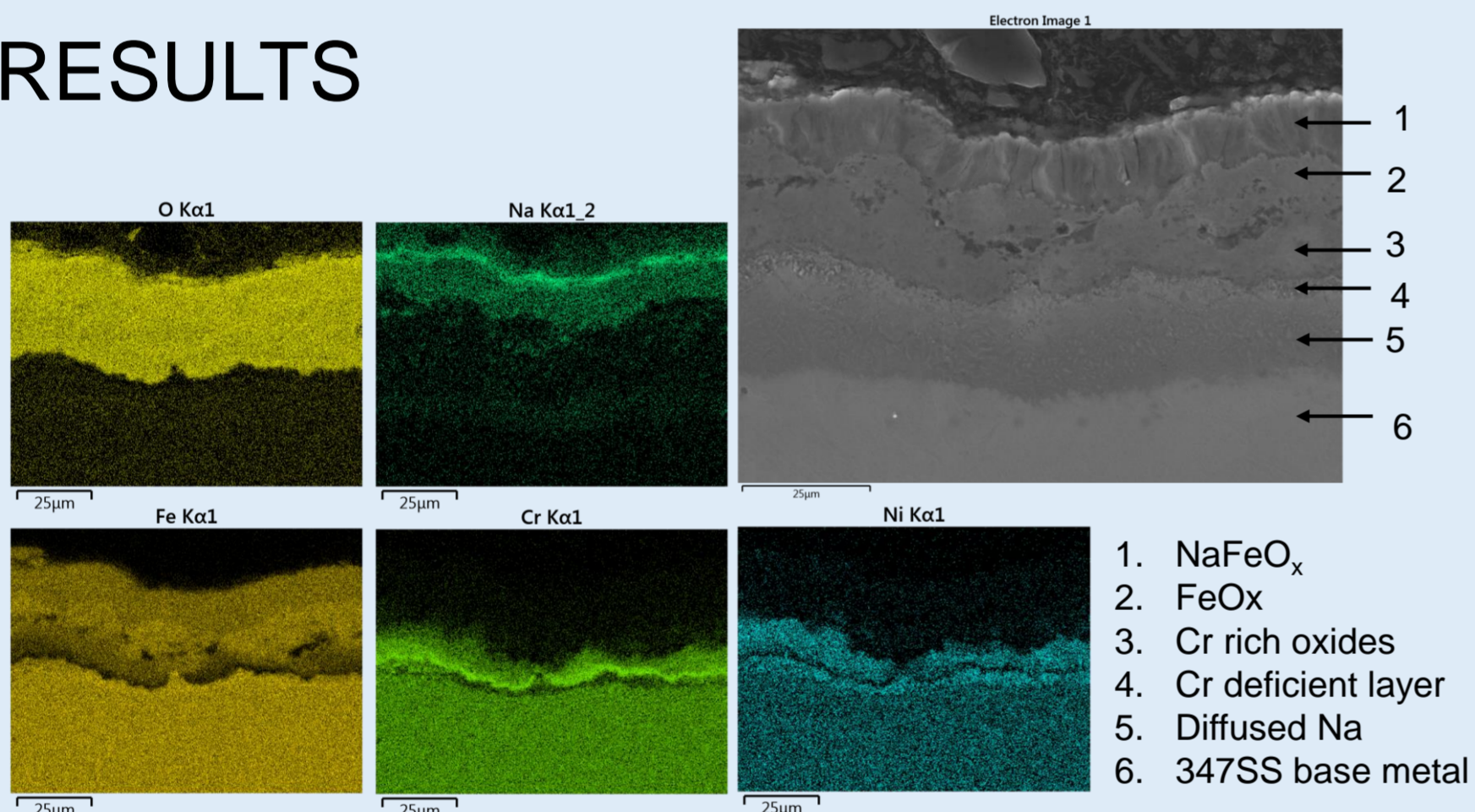
- To investigate suitable corrosion resistant coatings
- For use in presence of highly corrosive molten nitrate salts at a temperature $\geq 565^\circ\text{C}$
 - To replace expensive specialized metal alloys, e.g. HA214, typically used in the hot molten storage tank

METHODOLOGY

- Plasma spray deposition
- Nickel aluminide coatings
- SEM, EDX and XRD
- Molten salt corrosion test



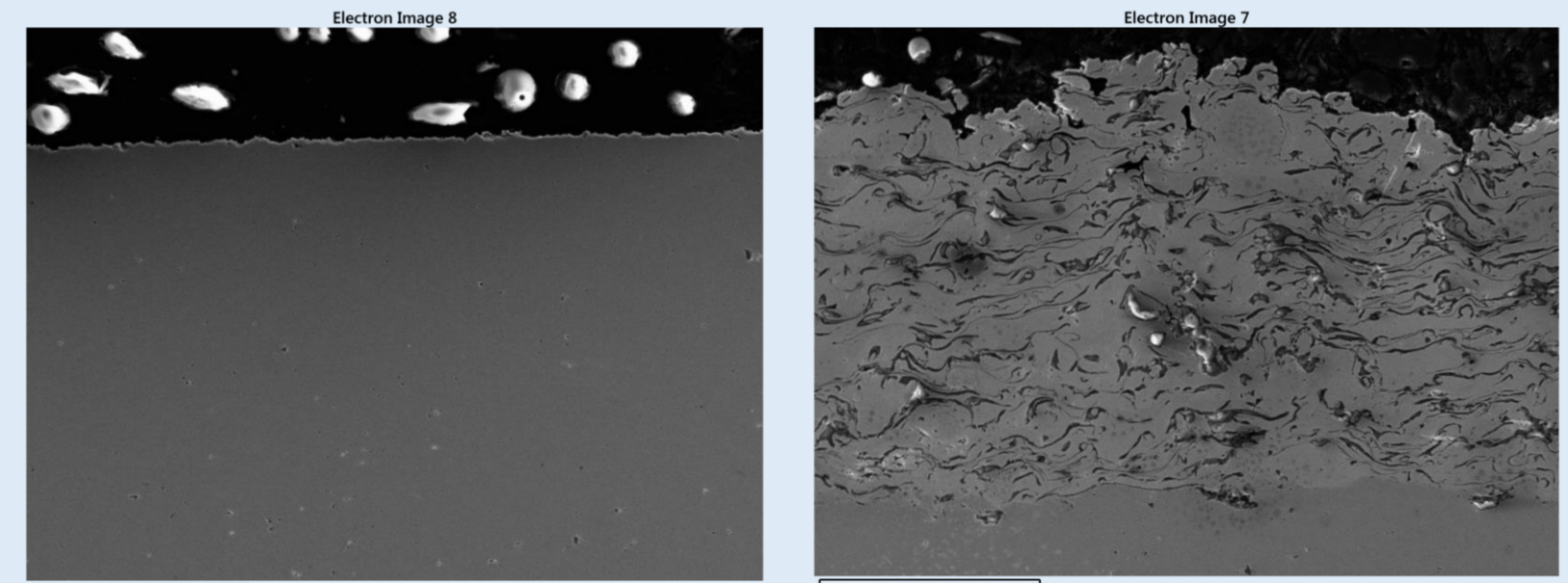
RESULTS



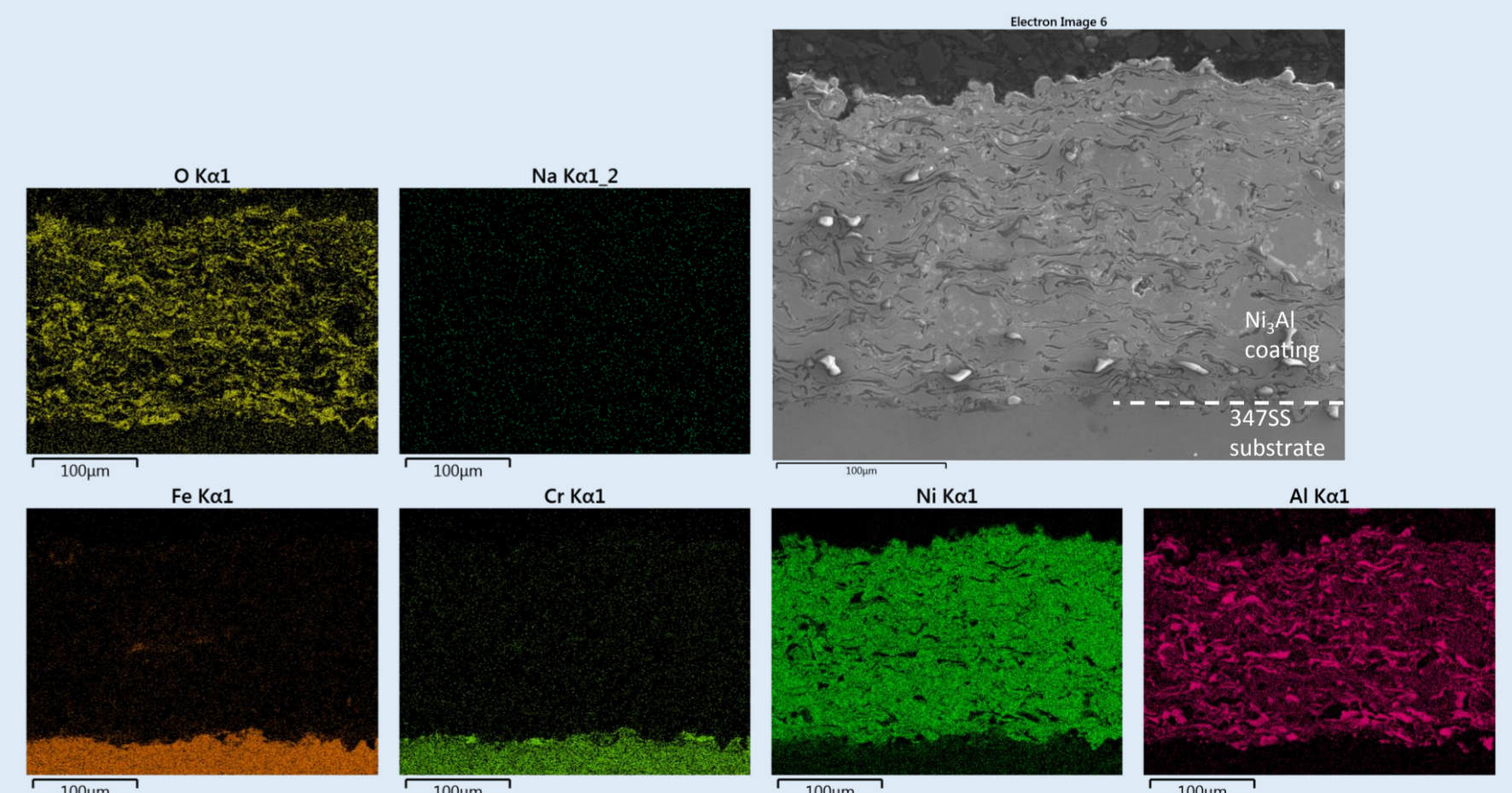
Bare 347SS after 3,000 hrs exposure to molten nitrate salt at 565°C

- Detected elements: Fe, Cr, Ni, O and Na
- Strong presence of O and Na on the surface, indicating the formation of NaFeO_x and FeO_x layers

Ni_3Al coated 347SS after 3,000 hrs exposure to molten nitrate salt at 565°C



Cross section of bare 347SS substrate and Ni_3Al coated 347SS before test .



KEY FINDINGS

- Corrosion of bare SS347 substrate: continuous growth of NaFeO_x , FeO_x , and Cr rich oxide layers, dissolution of Cr from and diffusion of Na into the substrate
- Ni_3Al coatings protected 347SS substrates from corrosion: rapid oxidation of coatings forming NiAlO_x passivation layer, no oxide formation on the base substrate

FUTURE WORK

- More systematic tests to elucidate mechanism, corrosion rate, and transition from incubation period to steady state
- Cyclic corrosion tests to simulate real conditions
- Corrosion test of coatings on cheaper substrates; bulk price of 304SS – €3,740, 347SS – €4,990 / metric ton

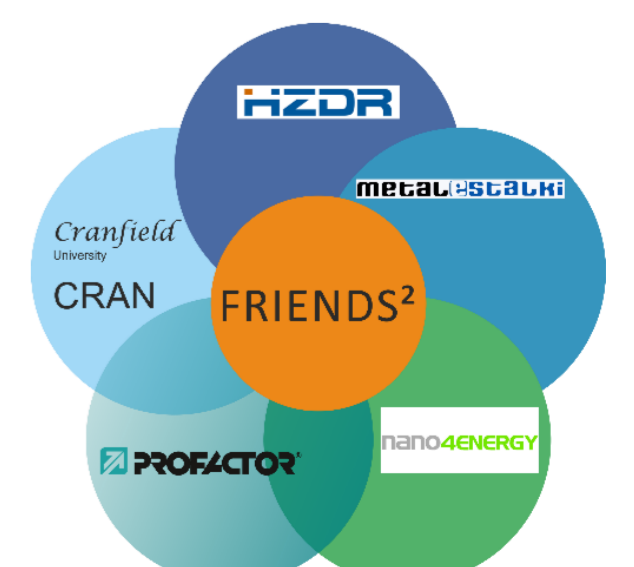
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