# Corrosion Behavior of STS316H in High-Temperature NaCl+MgCl2 Molten Salt for Next-Generation Molten Salt Reactor

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## 1. Introduction

Molten salt reactors (MSRs) employ molten salt as the main coolant in their primary cooling loop, which differs from traditional light water reactors. This approach leads to greater thermal efficiency and generates less nuclear waste. However, the commercialization of MSRs is hindered by the challenge of corrosion in the high-temperature molten salt environment. To investigate corrosion under these conditions, a glove box was utilized to simulate an atmosphere akin to that of an MSR. The moisture and oxygen levels were meticulously controlled to remain below 5 ppm, and a mixture of high-purity NaCl and MgCl2 salts was prepared for the molten salt environment. Tafel polarization tests and immersion tests were then carried out to assess the suitability of pure nickel in this corrosive setting. [1][2][3]

## 2. Methods and Results

High purity NaCl+$MgCl_2$ salt was dried for 24 hours at 340℃ in a glove box where moisture and oxygen were controlled to be below 5ppm. It was then melted at the process point and maintained at 650℃. The immersion experiment was conducted by fixing STS316h using an alumina crucible and tube.

**Fig. 1. Glove box set up for corrosion test**

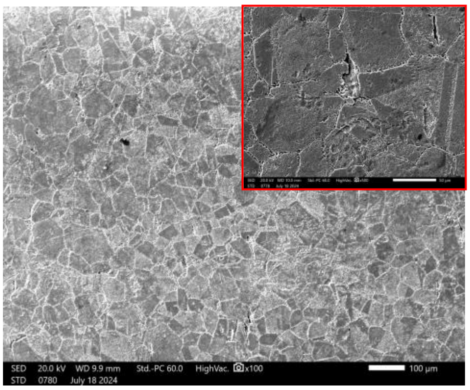

**Fig. 2. The surface condition after immersion**

Numerous grain boundary corrosions were observed on the surface after immersion, and delamination occurred as well. It was also confirmed that the concentration of chromium had somewhat decreased.

## 3. Conclusions

The results of this corrosion test show that the material under study exhibits a rapid rate of corrosion when exposed to a highly aggressive environment. The corrosion rate was calculated using the molten salt immersion method, and it was confirmed that corrosion progressed rapidly in the initial stage but gradually stabilized, resulting in a lower corrosion rate. The reduction in the corrosion rate was attributed to the precipitation of various oxides and molybdenum particles. However, since the corrosion rate is still significantly faster than expected, these results indicate that the material may not be suitable for use in highly corrosive environments. This highlights the need to reassess material selection, consider protective coatings, or explore alternative materials with better corrosion resistance. Additionally, this data is crucial for understanding the corrosion mechanism of the material and for establishing appropriate design criteria.

## REFERENCES

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