

Corrosion performance of In625 Coating at 500-700°C in Waste Incinerators

Haiyan Li¹, Jianquan Li¹, Huan Liu^{1,*}, Hong Yao¹

¹*School of Energy and Power Engineering, Huazhong University of Science and Technology*

Presenter's e-mail address: 3293363989@qq.com

Abstract In recent years, incineration has been the dominant way of waste disposal in China. High-temperature corrosion of the heat exchange tubes caused by the flue gas (HCl, SO₂, etc.) and deposits (ash rich in alkali salts) is a bottleneck problem that restricts the development of waste incineration technology. To alleviate corrosion, adding In625 coatings on the surface of heat exchange tubes by weld overlay is an effective method and has been widely applied. However, with the increasing trend of steam parameters, the performance of In625 in high-parameter boilers is still unclear and even at risk of deterioration. Given the higher service temperature, the corrosion behavior of boiler steel (12CrMoV) and In625 coating at 500-700°C were investigated under two corrosion conditions, namely the deposit corrosion and the coupling corrosion (deposits + flue gas). During the deposit corrosion, Cr and Mo in the material tended to be consumed, producing soluble products such as Na₂CrO₄/Na₂MoO₄, while Ni and Fe were mainly oxidized. The difference between the corrosion rates of 12CrMoV and 625 coating at 500°C is small. At 600/700°C, although the risk of Cr loss in the form of CrO₄²⁻ was increased from ~30% to ~70%, Ni/Cr/Mo/Nb in the In625 coating was still able to form a protective double-layer oxide. The linear corrosion rate of In625 is 30.8% and 59.3% of that of boiler steel, indicating good corrosion resistance. During the coupling corrosion, Ni and Fe were dominant both in both soluble corrosion products and oxide layers, while Cr and Mo were volatile as chlorides due to the high Cl partial pressure in the flue gas (containing HCl). At 500-700°C, the corrosion weight gain of In625 was 47%, 63%, and 78% of that of 12CrMoV, respectively. The increase in temperature would narrow the performance gap between the two materials but In625 could maintain its protectiveness.

Keywords Weld overlay; Inconel 625 coating; waste incineration; High-temperature corrosion

Reference

[1] W. Ma, T. Wenga, F. J. Frandsen, B. Yan, G. Chen. The fate of chlorine during MSW incineration: Vaporization, transformation, deposition, corrosion and remedies. *Progress in Energy and Combustion Science*, 2018, 76: 100789.

[2] X. Wang, Z. Liu, K. Cheng, Y. Shen, J. Li. Corrosion characteristics of Inconel 625 cladding layer and NiCrMoAl cladding layer in molten NaCl-KCl and NaCl-KCl-Na₂SO₄. *Corrosion Science*, 2023, 221: 111308.