Effect of chlorides and sulfates on the corrosion of SS347 and GH3539 in molten solar salt

Yanli Wang[a], Jinning Huang[a], Huijun Liu[b], Lingxu Yang[b], Chaoliu Zeng[b, *]

[a] *School of Chemistry and Chemical Engineering, Guangxi University, Nanning, 530004, P R China*

[b] *Songshan Lake Materials Laboratory, Dongguan, 523808, P R China*

** Corresponding authors: Chaoliu Zeng*

E-mail address: clzeng@imr.ac.cn (Chaoliu Zeng).

Abstract Adding an appropriate amount of chloride or sulfate salts to molten nitrates is an effective way to improve the thermal stability temperature and energy density of solar salts. However, the corrosivity of the mixed solar salts is enhanced significantly. In this paper, the effect of chlorides and sulfates on the corrosion of SS347 and GH3539 in molten solar salt is investigated. The high oxygen pressure and basic environment in molten nitrates causes the formation of an external Fe oxides layer and inner $FeCr_2O_4$ layer for SS347. Unlike SS347, the corroded GH3539 presents an exclusive film of NiO and many core-shell structured nodules with Ni as core and NiO as shell, followed by a region of internal oxidation involving Ni, W and Cr. The additives chlorides produce an oxidation-chlorination environment, causing spallation of oxide scale from SS347, but without significant effect on GH3539 due to lower thermodynamic stabilities of Ni and W chlorides than Fe and Cr chlorides. The addition of sulfates to solar salt also harms the adhesion of the scale on SS347 to a certain extent. While the additives sulfides accelerate the corrosion of GH3539, forming a thick porous NiO layer and a serious internal sulfidation zone.