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P4.196 Improved analysis on corrosion profile of liquid lithium in 304 stainless steel by LIBS

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Liquid lithium can cause serious corrosion on the surface of metal structural materials that used in the blanket and first wall of fusion device. Fast and accurate compositional depth profile measurement for the boundary layer of the corroded specimen will reveal the clues for the understanding and evaluation of the liquid lithium corrosion process as well as the involved corrosion mechanism. In this paper, laser induced breakdown spectroscopy (LIBS) technology was used to study the matrix element (Fe, Cr, Ni, Mn) and the corrosion medium Li in the surface layer of 304 stainless steel which was corroded by liquid lithium at 450℃ for 50 days. In order to improve analysis accuracy, LIBS signal acquisition with different time delays was performed. The variation curves of the complete spectrum and the corresponding curve of some element characteristics with the acquisition time were compared. The appropriate time delay was selected to ensure a higher signal intensity and, at the same time, to minimize bremsstrahlung interference. In addition, both of the intensity and area of the characteristic lines are used to characterize the specific elements, and the peak area shows a better performance in stability and repeatability. The experimental results reveal that LIBS can be used to detect various elements in the sample, especially Li, which provides us the trend of the element concentration in the depth direction. The experimental data also reveal that Li penetrates into the surface layer of stainless steel with Fe concentration in the surface layer almost unchanged, Ni lossy, Cr and Mn concentration fluctuated. Our study further demonstrates that spectral measurement by LIBS is an effective method in the field of metal liquid lithium corrosion research.

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