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Passivity and repassivation mechanism of stainless steels containing molybdenum

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In this work we studied series of stainless steels with varying Cr, Ni, Mn and Mo contents, to systematically break down the contribution of individual elements to the passivity of the alloys, and to understand repassivation mechanism after a damage occurs. To access the single element contribution on the stability of the alloys, ICP-MS is employed, a technique that is capable to elementally resolve the released materials from the alloys during corrosion and passivation. We use a newly designed electrochemical flow cell coupled with downstream ICP-MS detection. By systematically combining a material library we have successfully identified the influence of individual principal elements on the electrochemical properties and corrosion resistivity of alloys. We provide a detailed mechanistic understanding in the passive region. To characterize the passive layer, complementary XPS and LEIS measurements were performed, indicating that Mo forms insoluble passive layers that can however dissolve under cathodic conditions, and in the presence of chlorides.

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