Corrosion fatigue damage mechanism of high-strength aluminum ally based on in situ three-dimensional tomography

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Abstract：Corrosion fatigue is one of the important reasons for the rapid failure of engineering structures in marine engineering, rail transit, nuclear industry, etc. To reveal the corrosion fatigue damage mechanism and propose targeted protection methods, the key is to study the damage evolution behavior in corrosion fatigue failure process. However, due to the existence of corrosive media, the evolution behavior of pitting and cracking during corrosion fatigue cannot be obtained by the commonly used two-dimensional destructive characterization methods. How to obtain the spatio-temporal evolution law of corrosion fatigue surface pits and internal cracks in situ and visually has become one of the important challenges to be solved in the field of corrosion fatigue. Therefore, based on the advanced scientific device of light source, this project developed an in-situ corrosion fatigue testing machine compatible with synchrotron radiation imaging line station. The in-situ corrosion fatigue experiment of 7050 high-strength aluminum alloy was carried out, and the space-time evolution law of pitting and cracking during corrosion fatigue was obtained. Several main growth modes of pitting were clarified, and the relationship between the growth rate of corrosion fatigue crack and the range of stress intensity factor was established.