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论文

时效制度对Al-Zn-Mg-Cu铝合金应力腐蚀敏感性的影响

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摘要：

采用恒载荷拉伸应力腐蚀试样、恒变形C环应力腐蚀试样以及预裂纹双悬臂(DCB)试样，对不同时效制度处理的7B04预拉伸厚板的应力腐蚀性能进行测 定，并进行了扫描电镜断口形貌分析.研究表明，其抗应力腐蚀性能与时效制度密切相关，从峰值时效T6状态到过时效T74、T73状态，应力腐蚀敏感性依次降低.预拉伸厚板T6状态的应力腐蚀门槛值为120 MPa，而T74状态的应力腐蚀门槛值为300 MPa.T74状态的应力腐蚀开裂应力强度因子 KISCC是T6的近2倍，且应力腐蚀裂纹扩展速率(da/dt)也明显降低.T6状态和T74状态的7B04铝合金应力腐蚀断裂为沿晶断裂，并有二次裂纹.而T73状态的断口形貌无典型的应力腐蚀沿晶断裂特征，为孔洞腐蚀特征，而且其 KISCC几乎接近KIC.这说明T73状态的7B04铝合金几乎没有应力腐蚀敏感性.

关键词： Al-Zn-Mg-Cu铝合金 时效制度 应力腐蚀敏

Effect of Tempered Conditions on the Stress Corrosion Cracking of Al-Zn-Mg-Cu Alloy

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Abstract:

High strength Al-Zn-Mg-Cu aluminum alloys are widely used in airframe construction.However,this series of alloys are susceptible to stress corrosion cracking (SCC) to limit their usefulness.The tempered conditions and microstructural characteristics of Al-Zn-Mg-Cu aluminum alloys are well known to have a strong effect on SCC susceptibility.7B04 aluminum alloy belongs to Al-Zn-Mg-Cu alloys and is gained from 7A04 alloy through purification.The purpose of this investigation is to evaluate the influence of tempered conditions upon the SCC susceptibility of 7B04 alloy.The SCC behavior of 7B04 plate material was investigated in short transverse direction performing constant load test usi ng uniaxially smooth tension specimens,constant strain loaded tests using C-ring specimens and pre-cracking tests using double cantilever beam (DCB) specimens.The study also included the fractography examination by scanning electron micrograph (SEM).The results show that the resistance of SCC is much related to the tempered conditions.The SCC susceptibility of 7B04 alloy decreases from the near peak strength of T6 temper to over-aging T74 then to T73 condition.The threshold values of stress corrosion cracking (σth) of T6 temper and T74 temperare 120 MPa and 300 MPa respectively.The threshold stress intensity factor for susceptibility to stress corrosion cracking (KISCC) of T74 temper is two times of T6 temper and the stage Ⅱ crack growth rate (da /dt) Ⅱ of T74 temper is also much lower than that of T651 temper.The fractographs of T6 temper and T74 temper reveal intergranular fracture.While the fractographs of T73 temper do not show intergranular fracture,but pitting corrosion characteristic and the KISCC is almost the same as KIC .This indicates that there is hardly SCC susceptibility for T73 temper.That is related to the microstructure difference when the temper is different.The main precipitated phases in the T6 temper are composed of G.P zone and small quantity of η′ phase,there is not the obvious precipitated free zone(PFZ),while in the T74 temper there are η′ and η phases and their sizes are getting bigger, and the precipitate free zone (PFZ) gets wider.The increasing of precipitate size and PFZ can generally improve the SCC resistance.

Keywords: Al-Zn-Mg-Cu aluminum alloy stress corrosion cracking tempered conditions

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