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TC6钛合金4种典型组织的动态力学行为研究

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Study on dynamic mechanical behavior of four kinds of typical microstructure of TC6 titanium alloy

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摘要 采用分离式霍普金森压杆技术,研究了4种典型组织TC6钛合金试样在高应变率加载条件(10^3 s^{-1})下的动态力学行为,并分析了原始组织对动态力学行为的影响.结果表明:在高应变率加载条件下,4种典型组织TC6钛合金的流变应力显示了相同的变化规律:变形初期,应变较小时,流变应力随应变增加快速增加;随后流变应力出现振荡,应力达到峰值后,流变应力随应变的增大而逐渐减小,呈现稳态流变;最后流变应力快速下降;在10^3 s^{-1}数量级的高应变率加载条件下,随着应变率的增加,4种组织的流变应力均呈上升趋势;4种组织TC6钛合金都是应变率敏感材料,但4种组织的应变率效应不同;63#网蓝组织显示了较高的应变率敏感性,64#固溶时效组织则表现出较低的应变率敏感性,61#等轴组织和62#双态组织应变率敏感性相当.

关键词： TC6钛合金 高应变率 动态力学行为 应变率效应

Abstract： Using the technology of split Hopkinson bar,the dynamic mechanical behavior of four kinds of typical microstructure of TC6 titanium alloy under the condition of high strain-rate loading have been studied and the effects of original microstructure on the dynamic mechanical behavior have been analyzed.It is showed that the stress of the four typical microstructure of TC6 titanium alloy displayed the same variation rule under the condition of high strain-rate loading.At the beginning of deformation,strain is less and stress is quickly increased.The subsequent stress vibrates with increase of the strain.When reached the peak,the flow stress gradually decreases with the increase of the strain and displays a steady-state flow.The final stage of deformation,the flow stress fast fall down.The flow stresses of the four kinds of microstructure of TC6 titanium alloy display the ascending tendency with the increase of the strain-rate under the condition of high strain-rate of 10^3s^{-1} order.All of four kinds of microstructure of TC6 titanium alloy are sensitive materials to the strain-rate,but their strain-rate effects are different.The TC6 alloy with lamellar microstructure displays higher sensibility to the strain-rate,whereas the TC6 alloy with the solution and aging microstructure displays lower sensibility to the strain-rate.The sensibility of the equiaxed microstructure to the strain-rate is similar to that of the binary microstructure.

Key words： TC6 titanium alloy high strain-rate dynamic mechanical behavior effects of strain-rate

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