复合材料学报 2010, 27(1) 62-67 DOI: ISSN: 1000-3851 CN: 11-1801/TB

论文

40 vol%SiC_P/2024Al 复合材料的动态压缩性能

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摘要：

利用分离式霍普金森压杆(SHPB) 研究了40 %体积分数的SiC_P/2024Al复合材料和基体材2024Al 在不同应变率下的动态压缩性能。在高应变率动态压缩时该复合材料与2024Al 均表现出应变率不敏感复合材料屈服应力高于2024Al；与2024Al的应变硬化性能不同 ，复合材料表现出应变软化性能。利用扫描电(SEM) 观察动态压缩后复合材料试件的微观组织，发现试件内部出现一些孔洞、微裂纹以及一些增强颗粒的碎等损伤现象，并且在较高应变率下基体呈现出明显的热软化甚至发生局部熔化，由此判断，在高应变率SiC_P/2024Al复合材料宏观应变软化的机制为内部损伤及基体热软化。将 SiC_P/2024Al复合材料与2024Al 400℃下烧蚀3 h后自由冷却至室温，利用SHPB再次进行测试，与烧蚀前的测试结果相比，2024Al 的性能明显降，而复合材料的性能变化较小，表现出比基体材料更好的抗高温稳定性能。

关键词： 金属基复合材料 动态压缩 损伤 热软化 高温烧蚀

Dynamic compressive properties of 40 vol %SiC_P/2024Al composite

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Abstract:

Dynamic compressive properties of a 40 vol %SiC_P/2024Al composite and it s matrix 2024Al were studied at various strain rates using split Hopkinson pressure bar (SHPB). The flow stress of the composite and 2024Al is strain-rate insensitive above 1500 s^{-1}, and the composite yield strength is higher than that of 2024Al. Different from the strain-hardening property of 2024Al, a st rain-softening performance is found in the compressive properties of the composite. Microstructure of the compressed composite specimens was characterized by SEM, some cavities, micro-cracks and particle fractures were observed in the specimens, and the matrix of the composite was softened, even melted by heat at higher strain rates. The strain-softening performance of the SiC_P/2024Al composite at high strain rates is due to the inner damage and the heat softening. After being baked 3 h at 400℃ and self-cooling to the room temperature, the specimens of the composite and 2024Al were tested by SHPB. Compared to the original results, the mechanical properties of the matrix material are decreased significantly, but the property change of the composite is not obvious. The SiC_P/2024Al composite presents a much better mechanical property stability withstanding high temperature than the matrix.

Keywords: metal mat rix composites dynamic compression damage thermal sof tening high2temperature bakeconductivity

收稿日期 2008-12-29 修回日期 2009-04-15 网络版发布日期

DOI:

基金项目:

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