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TiC颗粒增强钛基复合材料的静动态力学性能

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摘 要：利用伺服式疲劳实验机和杆-杆型冲击拉伸实验机对TiC颗粒增强钛基复合材料TP650和基体钛合金的静动态力学性能进行研究，得到不同应变率下复合材料的应力—应变曲线。结果表明，复合材料和基体材料的屈服应力均随应变率的增加而提高，属于应变率敏感材料；TP650的破坏形式以颗粒附近基体的撕裂以及颗粒与基体合金的脱粘为主，几乎没有发生颗粒破碎现象。假设复合材料的微观结构为非均质单胞在空间的周期性重复排列，利用有限元软件对钛基复合材料的静动态力学性能进行数值模拟研究，计算结果与实验结果吻合良好。进一步通过数值模拟预测了颗粒形状和颗粒体积分数的变化对TiC颗粒增强钛基复合材料静动态力学性能的影响。

关键字： 钛基复合材料；颗粒增强；力学性能；数值模拟

Static and dynamic behaviors of TiC particle reinforced titanium matrix composites

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Abstract: Static and dynamic behaviors of TiC particle reinforced titanium matrix composite TP650 and titanium alloy matrix were studied by MTS810 testing apparatus and a split Hopkinson tension bar (SHTB), and the stress—strain curves of materials at different strain rates were obtained. The results show that with the strain rate increasing, the yield stresses of the composites and the matrix (a strain rate sensitive material) also increase. The dominating failure types of TP650 are tearing in matrix around particles and debonding between particles and matrix along with few particle fractures. Assuming that the inhomogeneous cells of composites are arrayed periodically in space, the numerical simulations of static and dynamic behaviors of titanium matrix composites with finite element software are carried out and the results agree with experiment results well. The effects of particle shape and particle volume fraction on the static and dynamic behaviors of TiC particle reinforced titanium matrix composites are also predicted by numerical simulations.

Key words: titanium matrix composites; particle reinforced; mechanical properties; numerical simulation

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