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带围带的涡轮叶栅间隙泄漏流动与气动性能实验

Experiment on clearance leakage flow and aerodynamic performance in shrouded turbine cascade

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中文关键词: [涡轮叶栅](#) [围带](#) [间隙泄漏](#) [掺混损失](#) [气动特性](#)

英文关键词: [turbine cascade](#) [shroud](#) [clearance leakage](#) [mixing loss](#) [aerodynamic performance](#)

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中文摘要:

针对叶型转折角为 108.1° 的涡轮直叶栅, 利用低速风洞, 实验研究了带围带和无围带情况下叶栅出口截面的流场结构和叶栅气动性能. 研究了不同围带上腔间隙、不同来流冲角情况下叶栅出口截面二次流结构、气流角分布及总压损失系数变化情况. 结果表明: 相对无围带叶栅, 围带能够有效控制叶顶间隙泄漏, 降低叶栅气动损失; 随着围带与上端壁之间高度的增大, 泄漏流体增多, 导致泄漏流体与主流掺混的气动损失增大. 对于所研究的叶栅, 围带与端壁间的间隙高度不应大于1%叶展. 冲角变化影响叶栅中的三维涡系结构及其强度, 对叶片吸力面静压分布影响较为明显. 适当的正冲角能够改善流动状况, 进而提高大转折角叶栅的气动性能.

英文摘要:

Flow structure at the exit of turbine cascades and aerodynamic performance were studied experimentally in a low speed wind tunnel for unshrouded and shrouded blades with a turning angle of 108.1° . The secondary structure, distribution of flow angles and total pressure loss coefficient on exit planes were investigated under various working conditions, including different clearances between the blade and the casing and different angles of incidence. Experimental results show that, compared with the unshrouded turbine cascades, the shroud can effectively control tip clearance leakage flow and reduce aerodynamic loss of cascade. With the growing clearance between the shroud and casing, the amount of leaked fluid increases. Consequently the mixing loss induced by the leaked fluid becomes larger. For the cascade studied hereto, the clearance should be less than 1% span of the blade. Variation of angle of incidence influences three-dimensional vortex structures and their intensity in cascade passages. Also it clearly affects static pressure distribution on the suction surface of the blade. Proper and positive angle of incidence helps improve the flow field, thus enhancing aerodynamics performance for cascades with large turning angles.

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