

学术论文

钢-混凝土组合结构抗火性能研究与应用

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摘要:

钢-混凝土组合结构抗火性能研究是当前的研究热点之一, 国内外学者对此展开大量试验研究和理论分析。通过介绍国内外研究者在组合板、组合梁、组合柱等构件以及结构节点和结构体系抗火性能方面研究概况, 分析了我国现有防火设计规范的特点以及工程应用情况, 指出现有研究的不足, 对组合结构抗火研究领域在高温材料热-力耦合本构关系、计算理论、数值火灾试验和设计方法等方面需进一步研究的工作进行了展望。文中指出, 建立考虑升降温、多轴应力状态、不同加卸载路径的钢材和混凝土热-力耦合本构关系, 建立基于整体性能、考虑升降温全过程的结构抗火分析理论, 建立整体结构数值火灾试验方法, 提出“三水准”结构抗火设计与灾后结构损伤评估原则以及基于时变可靠度和结构整体性能的组合结构抗火设计方法是钢-混凝土组合结构抗火性能研究的关键科学问题。 表2参119

关键词: 组合结构 抗火性能 耐火极限 抗火设计 火灾全过程

Fire performance research and application on steel-concrete composite structures

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Abstract:

Fire performance of steel-concrete composite structures has been a focal point of research for recent years. Many experimental tests and theoretical analysis have been carried out by researchers all over the world. This paper summarizes the recent achievements made in fire performance of composite slabs, composite beams, composite columns, beam-column connections, frames and structural system. The features of the code for fire protection design and the practical application are also analyzed. The prime problems existing in the field of fire performance are pointed out in this paper. The issues related to the fire performance of composite structures, such as material thermal-stress coupled constitutive model, analytical theory, numerical fire testing, and fire performance design method which require further research are discussed. Five key problems concerning with fire performance of steel-concrete composite structures are identified: (1) The thermal-stress coupled constitutive models of steel and concrete, which consider the factors such as heating and post-fire cooling, multi-axial stress states, and different routes of load and unload, should be proposed; (2) The analytical methods for fire performance of composite structures considering heating and post-fire cooling should be established based on global structural behavior; (3) The numerical fire testing method for the global structural should be established; (4) The ‘three level’ fire performance design for structures and principles of damage assessment for structures after fire should be established; (5) The design methods for composite structures should be proposed based on time-dependent reliability and global structural behavior. 119 Refs. In Chinese.

Keywords: composite structure fire performance fire resistance fire-resistance design full-range fire

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