Investigation of Natural Fibre Reinforced Cementitious Composite for Structural Retrofitting of Building Structures

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Summary

Many masonry building structures are vulnerable to a seismic event. There are many structural retrofitting technologies available, such as glass/carbon fibre reinforced polymeric matrix composite. However, it is difficult to protect the polymeric matrix from fire in building structures. To fundamentally improve the fire resistance of retrofitting material, it can simply change the polymeric matrix to cement based matrix. This kind of composite is called fibre reinforced cementitious matrix (FRCM). It consists of high performance manmade fibre such as AR glass, carbon, basalt or Kevlar and it is extensively investigated by different researchers. It provides an excellent alternative for engineers to structural retrofit building structures for which fire is one of major design concerns. Ironically, most of the earthquake active zones are in the poorest region in the world because of continuous attack by natural disasters. In those regions, the building structures are the most vulnerable to an extreme event such as earthquake and there is a need for structural retrofitting. Due to poor economic development of those regions, it is unaffordable to apply high performance manmade fibre to achieve the purpose. One practical solution is to develop a technically feasible,economically viable and environmentally sustainable is to replace high performance manmade fibre by locally available natural fibre in FRCM. A technical challenge is the durability of natural fibre in the high alkalinity environment of cementitious matrix. In this presentation, the effects of different treatment methods on sisal fibre as well as how to extract the mechanical and bond parameters of treated fibre from pull-out test under accelerated ageing test will be discussed.

Keywords: Fibre reinforced cementitious matrix, sisal fibre, pull-out test, bond parameters.

1. Introduction

There were tens of thousands of casualties in earthquakes due to the collapse of improperly designed and built residential buildings, especially in developing countries and poor regions, such as Haiti 2010, Indian Ocean 2004, Kashmir 2005 and Sichuan 2008. Fibre reinforced polymer (FRP) has been widely used to strengthen/retrofit reinforced concrete as well as masonry structures because of its excellent mechanical properties, high corrosive resistance, flexibility and ease of applications. However, there are several drawbacks of using FRP to retrofit building that include careful fire design, inapplicable on moist surface as well as incompatible thermal and mechanical properties to substrate materials. There is another promising alternative that simply replaces the polymeric matrix by cementitious matrix. This material is named fibre reinforced cementitious matrix (FRCM). The installation procedure is similar to nominal plastering work. There are existing guidelines available to design and construct FRCM [1,2]. It specifies the materials used and design considerations. However, it only considers the use of high performance manmade fibre such as aramid, alkali resistant (AR) glass, carbon and polyparaphenylene benz obisoxazole (PBO). There has been extensive research on using FRCM to retrofit reinforced concrete and masonry structures in structural level with high performance manmade fibre [3, 4, 5]. Unlike FRP strengthened beam,

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