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The Experimental Fracture Mechanics Single Contoured-Cantilever Beam Specimen

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Introduction

Construction practices involving the rehabilitating, retrofittingand reinforcing of concrete structures using fiber reinforced polymer (FRP) fabrics have been well documented. Experimental efforts to characterize the effectiYeness of this technology, however, have included many large scale FRP-concrete tests for strengthstiffness evaluations which do not detect delamination effects; small-scale tests, on the other hand, only provide average interface strength properties that neither describe failure mechanisms nor provide fracture toughness data. In this paper, the experimental fracture mechanics specimen known as the single contoured-cantilever beam (SCCB) was used to obtain important quantitative results of FRP-concrete interfaces as subject to a host of conditions: dry, freezing-thawing, wetting-drying, fatigue, and surface roughness eff ects on the integrity of the interface bond. The findings of this research effort demonstrate both the importance of surface preparation towards achieving an optimal bond as well as offering a means of gaging rates of degradation of the interface under a variety of commonly encountered construction environments.

External reinforcement by FRP sheets has been used to enhance construction of a variety of structures, e.g. bridges and buildings, as well as different engineering materials, e.g. concrete and steel. A central issue with this technology is in the integrity of the interface bond between the composite fabric and the underlying substrate. In order to quantify and characterize the interface, the experimental fracture mechanics specimen known as the single contoured-cantilever beam (SCCB) was used to study the bond under dry, i.e., control, conditions, as well as specimens as subjected to commonly encountered environmental fieOd conditions of freezingthawing and wetting-drying (Figure 4). Additionally, as bridges are routinely subjected to vehicular traffic resulting in repetitive loading and unloading of the structure, the SCCB setup was used to consider the eff ects of cyclic fatigue of the interface bond. Finally, the effects of surface roughness on the interface bond was also considered through three categories of concrete surface preparation: straight out of the mold, belt-sanded, and sand-blasted (as seen from Oeft to right .

Furthermore, owing to a large number of energy losses, global steel production's real resource efficiency is just 32.9 percent. With the increasingly increasing cost of primary oil, it is critical to increase energy efficiency in the iron and steel industry in order to minimise fossil fuel consumption and global CO2 emissions. To minimise the use of primary energy in steel plants, a variety of energy-saving technologies and steps are used.

In the iron and steel industry, these possible changes include composition management of incoming energy flows, modification of energy-related processes, and utilisation of outgoing flows. Various researches have partly achieved better energy consumption over the past decades, but the overall efficiency has not been significantly increased. Energy-saving technologies will continue to be relevant in the iron and steel industry in the future. These technologies should be tailored based on a mass network in order to reduce energy demands in the iron and steel industry.

The other significant energy-saving option is secondary energy recovery. By-products and waste heat make up the majority of secondary resources in iron and steel plants. Steelworks, which account for roughly 30% of total energy consumption in s, produce a considerable amount of outgoing excess gases such as coke oven gas (COG), blast furnace gas (BFG), and Linz-Donawitz gas (LDG). These tools may be used as fuel or to produce electricity and heat in a cost-effective manner. Via top pressure recovery turbine (TRT) technology, high- pressure BFG is recycled to generate electricity. COG as a potential feedstock for H2 separation, CH4 enrichment, and methanol processing; for example, has sparked a lot of interest in repurposing these gases to make high-value goods.