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Modelling of composite deformed steel decking floor under fire

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Steel structures are very critical when subjected to fire. This has been reflected in some recent engineering failures. It is even more critical for composite decking floor with openings which are quite common for commercial and hospital buildings. Numerical simulation of the thermal and structural performance of composite steel-decking flooring system will be discussed in this paper. In the research, a 3-D finite element method (FEM) model has been developed to simulate the time dependent temperature distribution within the concrete slab and steel decking sections by using the non-linear finite element program, ANSYS package. The composite floor has been modelled with exposure to the ISO834 standard fire for over two hours using transient, non-linear thermal analysis. A comparison between the numerical results and experimental results obtained from the fire test conducted were carried out which has shown a very close agreement. The validation has allowed the FE (Finite Element) model to be used for an in-depth assessment on the fire performance of composite steel decking floor under the elevated temperatures. The research has shown that fire performance of composite metal decking could be superior to the traditional steel with concrete slabs system.

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An assessment of the effects of varying martensite layer depth on the mechanical properties of quenched and self-tempered steel rebars

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After rolling quenched and self-tempered (QST) steel rebars, high water pressure is applied on the bar resulting in a martensite ring formation on the rebar surface. Subsequently, the core of the bar transforms to a high temperature transformation product and the martensite layer is tempered by the heat flowing outwards from the core. The combination of these two macro-constituents determine the overall mechanical properties of the bar. The depth of the martensite layer is an important material design parameter determining important material characteristics such as TS/YS ratio which is becoming increasingly of interest. A novel procedure to assess the relationship between the martensite layer depth and mechanical properties is devised in this work. Using industrially supplied QST rebars, a series of cylindrical samples of decreasing diameters have been prepared. By machining the samples to gradually decreasing diameters, the martensite ring is gradually removed until samples with only the core structure are obtained. Tensile testing is performed for all samples, therefore, enabling the assessment of varied martensite thickness effects on the mechanical properties of the overall rebar. The correlation between the amount of tempered martensite and yield strength, tensile strength, TS/YS ratio, elongation, reduction in area are characterized and quantified using this procedure.

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