Reg. No: 2023/49/N/ST8/03055; Principal Investigator: mgr inż. Wojciech Szymkuć

ABSTRACT

In recent years **Wojciech Szymkuć** – the **Principal Investigator (PI)** has focused on two scientific problems related to the performance of **Concrete-Filled Steel Tubular** (**CFST**) columns in fire: **(1)** developing **Lightweight Cementitious Composites with Cenosphere (LCCC)** with enhanced thermo-mechanical properties and **(2)** developing an advanced numerical model to analyse the structural behaviour of **CFST** columns. The results show that there is a special type of filling that can help achieve better performance of CFST columns at elevated temperatures. The proposed project aims to further explore the hot topics of structural fire engineering, by:

- testing **LCCC** before and after exposure to elevated temperatures (up to 1000 °C),
- testing **CFST** stub columns before and after exposure to elevated temperatures (up to 1000 °C),
- development of a mathematical more to describe the material
- numerical analyses of **(1)** the behaviour LCCC and **(2)** the structural response of CFST specimens before and after exposure to elevated temperatures.

The outcomes of the project will **(1)** enhance the current capabilities in modelling fire and the post-fire response of structural members and **(2)** add knowledge on the influence of elevated temperatures on the properties of building materials. The project consists of experimental and numerical parts. The numerical analysis will focus on the response of materials and CFST columns to heating.

The data provided in the experimental part will be used to develop new mathematical models and improve numerical models of CFST columns. **It is postulated that the fire resistance of Concrete-Filled Steel Tubular columns can be extensively improved by incorporating Lightweight Cementitious Composite with Cenosphere as a filling. The use of such composite will significantly increase the post-fire load-bearing capacity of columns.**

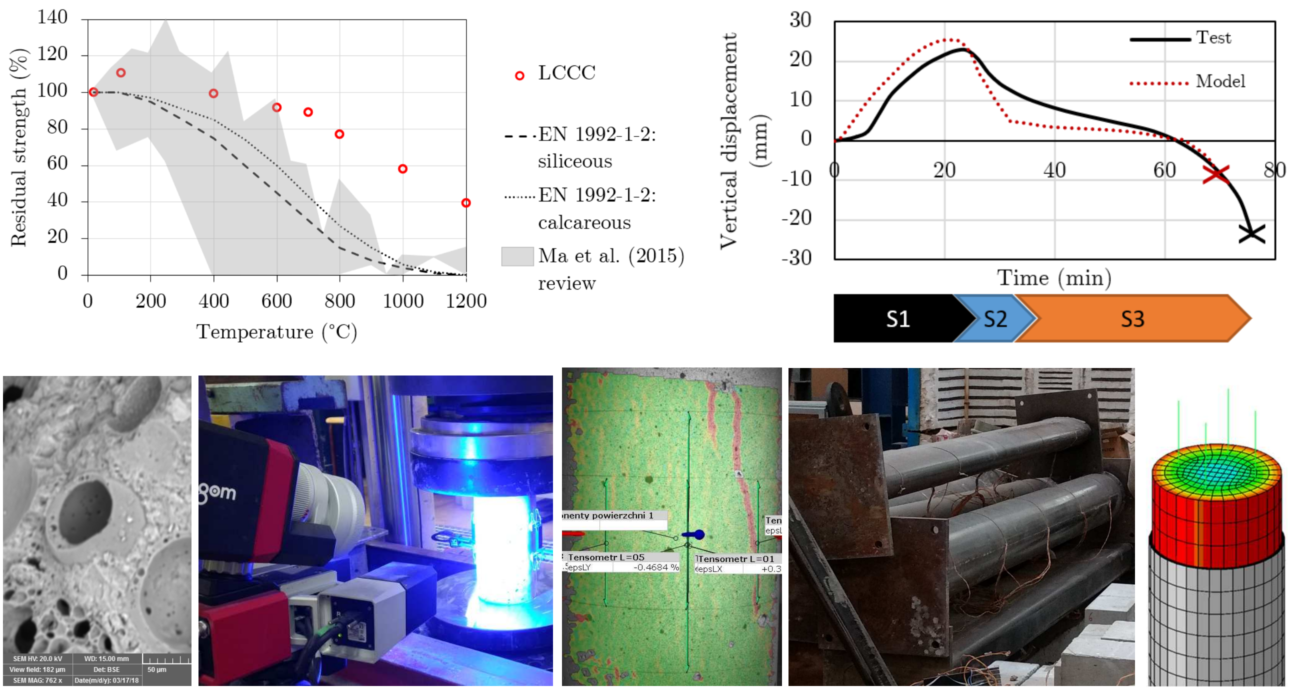

Fig. 1. The proposed research involves experimental testing and theoretical analysis.

Concrete structures can withstand fire for a long time. However, like steel, the concrete degrades due to elevated temperature. Furthermore, concrete might experience additional degradation after cooling. With the growing interest in modelling the physically-based fire exposure on structures, the knowledge of the material properties and behaviour of structural members during and after a fire is essential. The effect of cooling is not described in **EN 1992-1-2**, but it has been drawing considerable attention recently. That is why some provisions are introduced in the newest draft of **prEN 1992-1-2.** However, their applicability has not been extensively studied. That is why, the leading international organisations, such as **fib** and **RILEM** are investigating this matter. The author would like to add new insights into the understanding of post-fire behaviour of materials, structural members, and eventually – buildings. Because the proposed research involves both experimental and numerical research, Figure 1 depicts several factors covered in the proposal: material testing, microstructural investigations, data analysis and modelling of CFST columns.