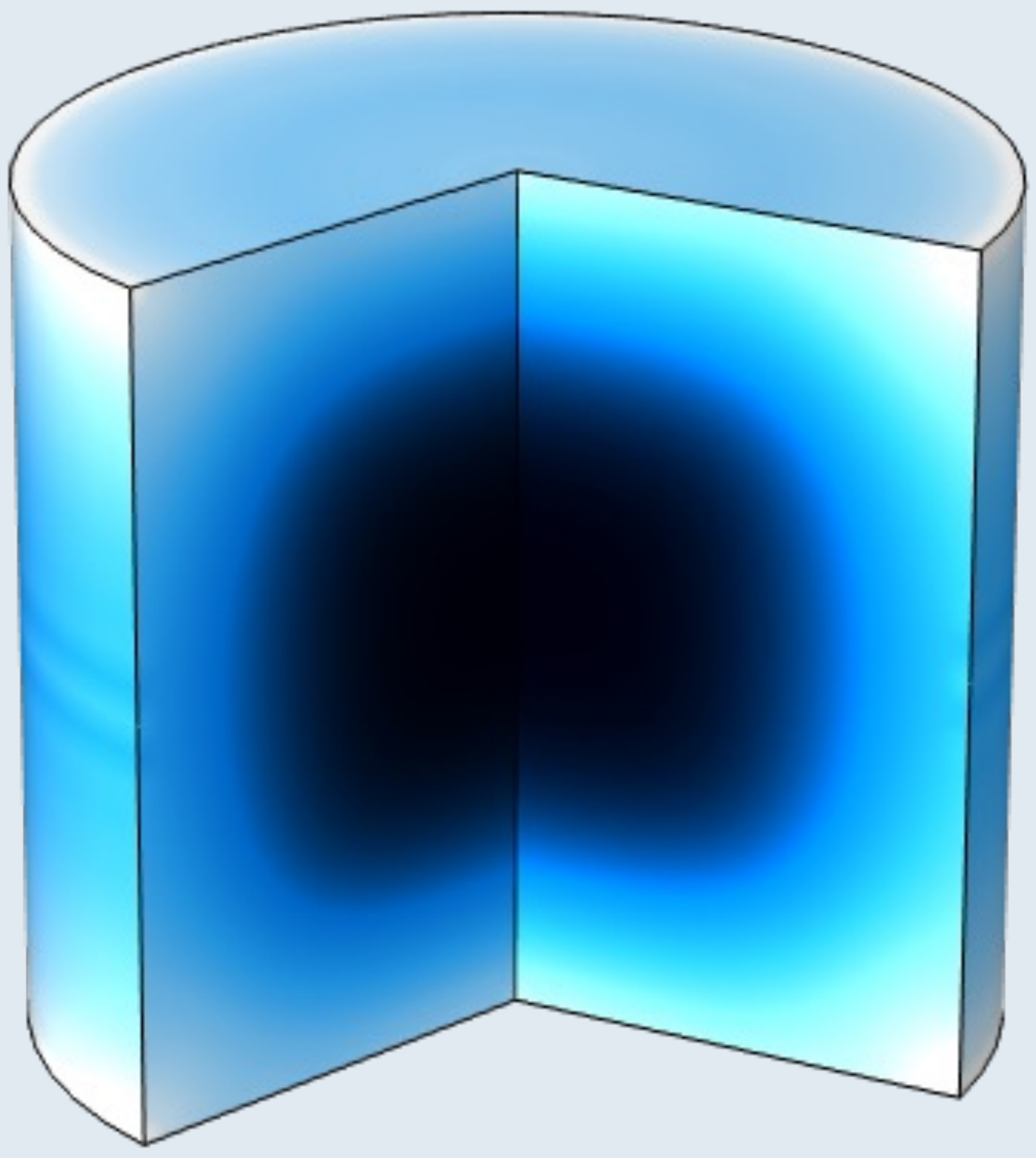

Drying of Refractory Materials

Understand the drying mechanism in a refractory material to save energy without any risk.

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Abstract

TRB company is developing a wide range of high-performance refractory products adapted to the needs of big industries such as blast furnace, steel works, foundry, cement, heat treatment furnace, etc... These products are formulated with silico-aluminous materials and other special compounds (SIC, graphite, zircon, etc.). Implementation process of these specific materials follows different steps: casting, curing, **drying** and heating. This poster focuses on the drying step, which is a very sensitive and complex process, especially when free water and bonded water are released from the material. A model has been developed with the help of COMSOL Multiphysics® to understand what is involved in this phenomenon, including moisture transport, heat transfer and poroelasticity. The aim of this study is to optimize drying schedules to decrease energy consumption while keeping the process safe from explosion risks.

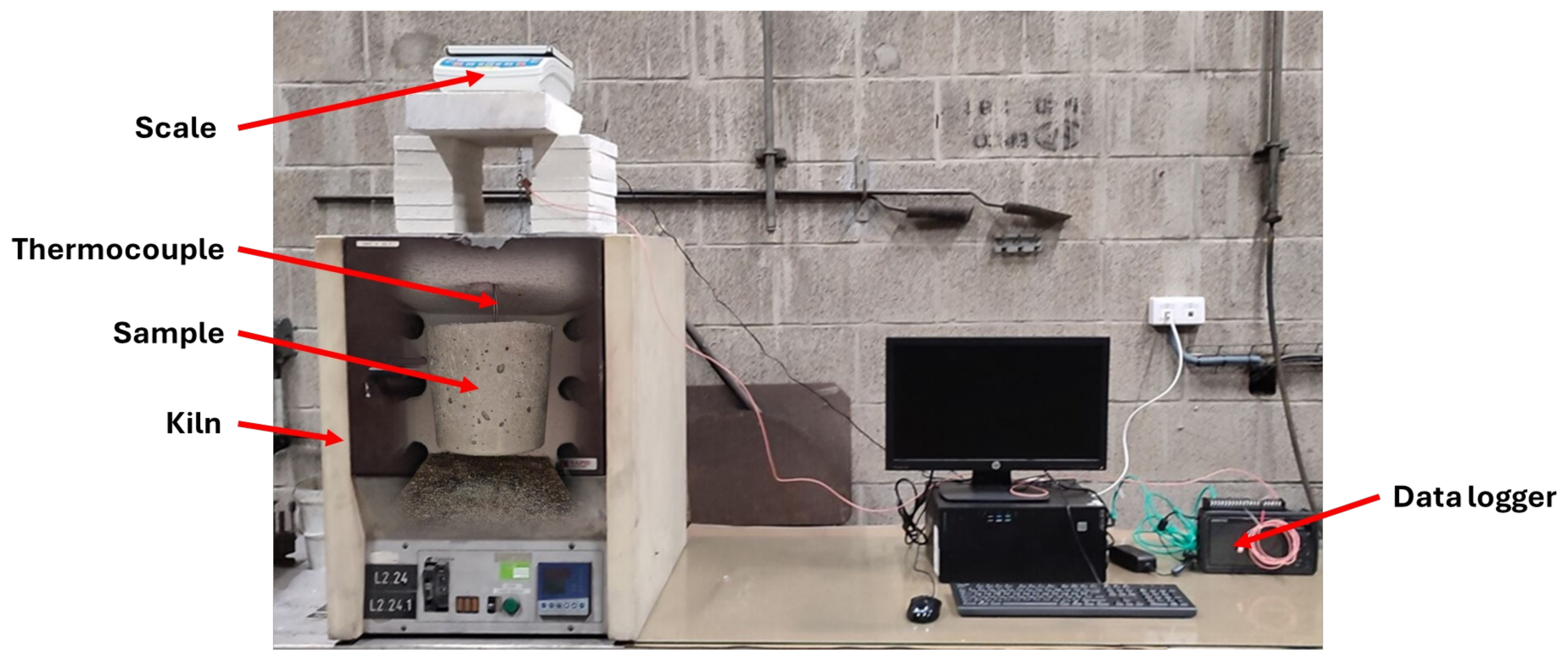

FIGURE 1. Lab test measuring the mass decrease during the drying stage

Methodology

A lab test has first been set to understand the kinematics of the water release while the temperature is increasing. After a curing stage, temperature and mass are both measured and recorded during the drying stage in a kiln (see *Figure 1*). Lot of parameters are influencing the test results including temperature schedule, cement and water content, porosity and permeability of the final material, curing time and temperature, ambient air humidity…

Results

Lab test parameters have been implemented in a COMSOL model. This problem includes a lot of coupling between different physics as illustrated in *Figure 2* below. Complete model isn't working yet, but first outcomes of a reduced model (without mechanics) and shorter time, are showing some promising results such as a good correlation between test and calculation mass balance (*Figure 3*).

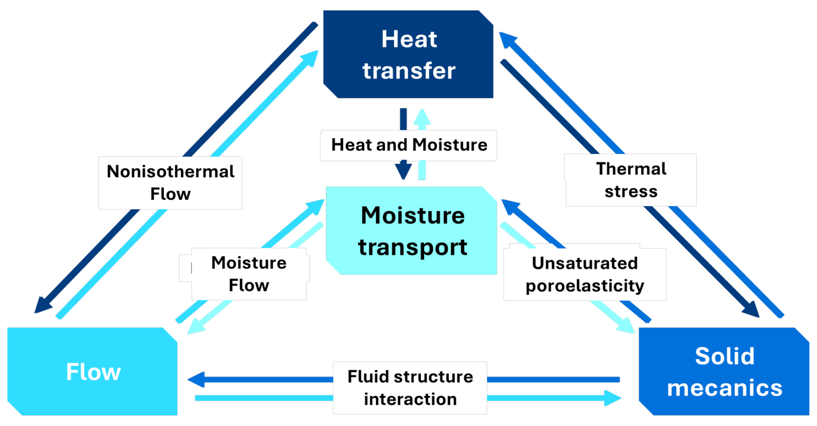

FIGURE 2. Model architecture including 4 physics and many coupling

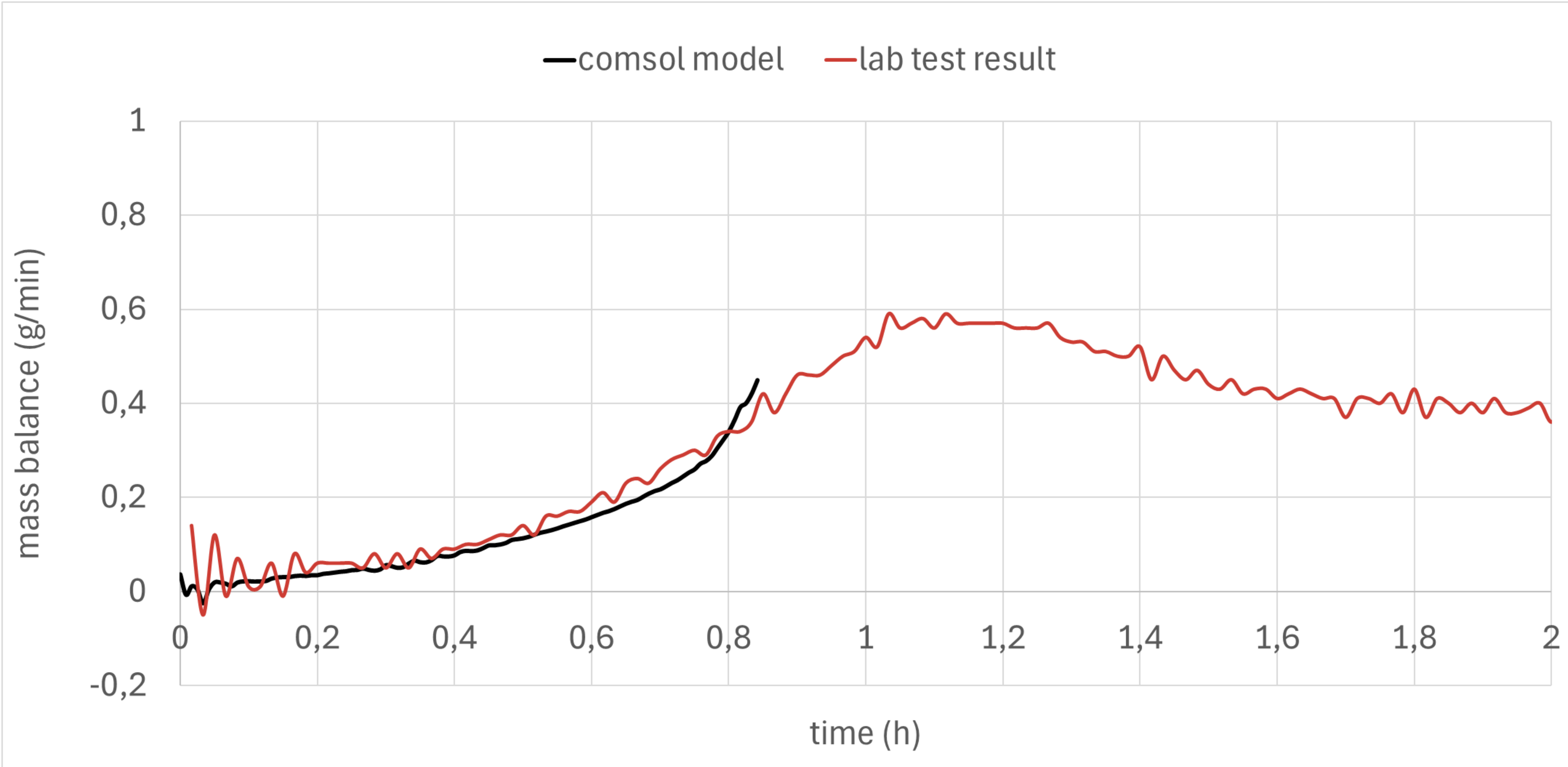

FIGURE 3. Comparison of the mass balance measured on the lab test and calculated with COMSOL model

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