Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

Wydział Budownictwa i Architektury

Imię i nazwisko autora rozprawy: mgr inż. Magdalena Bochenek

Dyscyplina naukowa: Budownictwo

Tytuł rozprawy w języku angielskim: **Evaluation of hygro-thermal properties variability in autoclaved aerated concrete of diverse density**

ABSTRACT

The subject matter described by this doctoral dissertation refers to some current trends, strongly reflected in the modern construction. The European Directives, widely implemented in building practice within the past few years, call for transition to the standard of Nearly Zero Energy Buildings in the near future. As a result of this implementation emerged a need for an introduction of the increasingly stricter norms in relation to the thermal and moisture aspects, necessary in a process of designing modern buildings of certain energy-related and environmental values.

To ensure adequate results of the conducted thermal and moisture measurements, it is crucial to obtain and have in disposal correctly determined hygro-thermal parameters, the values of which remain in close relationship between the material's porosity structure and its moisture condition. Meanwhile, the relevant literature shows deficiencies in providing systematic knowledge in the subject area, specifically in relation to the research on material parameters, conducted in consideration of mutual thermal, moisture and structural couplings.

This research includes studies on the equilibrium moisture state, indicating a relation between the moisture content in a material and the relative air humidity at a specified constant temperature. Consequently, it was essential to recreate the shape of sorption and desorption isotherms across the entire hygroscopic humidity range. Moreover, a humidity variability of moisture transport coefficients was recreated. That, in view of a highly problematic issue of non-linearity, required an application of a specific testing method, allowing for diagnosis of diffusivity values within a narrow subrange, extracted previously from within an entire hygroscopic range. Extensive testing of the transport coefficients entailed a need for conducting additional

measurements within over-hygroscopic range in order to determine the capillary sorption coefficients of tested materials.

In relation to the entire possible range of moisture, that includes hygroscopic as well as over-hygroscopic category, measurements of basic thermal parameters were conducted, e.g. conductivity and thermal capacity coefficient. By this means their functional dependency on moisture content in the material and in its environment was recreated.

Multistage experiment was concluded by simulation measurements on drying of partitions, previously exposed to excess moisture. In the following months of the experiment the variable profiles of moisture content through partition thickness were recreated, as well as variable in time allocation of conductivity and thermal capacity coefficients. The six-month-long experiment proved difficulties in relation to the energy situation between the analysed types of partitions, in particular those made of higher class autoclaved aerated concretes.

In every part of the experiment it was taken into consideration that the course of moisture transport depends largely on microstructural parameters of the porous material. These properties, along with the moisture conditions, codetermine the impact of the resultant flow of various mechanisms. Also the level of hygroscopic moisture equilibrium depends on the porous structure of the tested medium. In turn, the specific structural-moisture circumstances have an impact on primary thermal parameters of analysed group of materials, such as thermal conductivity and thermal capacity.

The conducted experiments and carried out analysis enabled positive verification of the main thesis of this doctoral dissertation, proving that both the equilibrium states as well as hygro-thermal parameters of the autoclaved aerated concrete exhibit strong and equally diverse dependence on moisture level and a specific microstructure of individual density classes.

The carried out experiments provided the effectiveness and precision tests of selected research methods, intended to evaluate a variability of the autoclaved aerated concrete hygro-thermal parameters.

15.04.2016 r. Bocheneк Magdalena