

Opponent's review of the Doctoral Thesis

Candidate Jiri Nemecek

Title of the doctoral thesis Micro-Scale Fracture Properties of
Cementitious Composites

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Topicality of the doctoral thesis theme

Commentary: The thesis deals with determination of mechanical properties of cementitious materials on the microscale. The topic is very important since understanding the properties at this scale will teach us the consequences if we change binder-systems of materials as concrete. The change of binder systems is a necessity in the future if we would like to keep concrete materials sustainable and contribute to decrease of CO₂-emissions in which cement-production has a big share at the moment.

excellent above average average below average poor

Fulfilment of the doctoral thesis objectives

Commentary: The objectives of thesis are development of methods for determining mechanical properties of cementitious systems (at the micro-scale) and measure these properties for certain systems using the developed methods.

Looking at the results of the thesis it is clear that the doctoral candidate fulfilled all these objectives. Various methods for measuring mechanical properties are developed and they are successfully applied to different materials.

excellent above average average below average poor

Research methods and procedures

Commentary: The thesis starts with a nice overview of methods for measuring mechanical properties on different scales and especially on the smaller micro-level-scales.

The methods used and developed in this thesis deal with testing of properties using nano-indentation on samples. These are either polished samples with regular nano-indentation or small samples obtained by FIB-milling in which individual phases are measured. These tests are rather unique for cement-based systems.

excellent above average average below average poor

Results of the doctoral thesis – dissertant's concrete achievements

Commentary: The achievements are mainly:

- giving an overview of tests methods for micro-scale characterisation of cement based materials

- developing test methods on the microscale of cement based materials by combining FIB-milling and nano-indentation methods.

- describing also the relation to other micro-scale experimental techniques and modelling

excellent above average average below average poor

Importance for practice and for development within a branch of science

Commentary: For practice the work is not directly important, which means practice will not directly benefit from the developed experimental methods. However the methods are important for science and research done in the academic world, since they describe techniques that can be used to measure microscale mechanical properties of cementitious systems. This forms the basis when developing new materials with different binders and for creating models that support this development.. Indirectly the construction industry will benefit, since they will use the new materials in the future.

excellent above average average below average poor

Formal layout of the doctoral thesis and the level of language used

Commentary: The thesis is well organised and structured. The use of English language is good.

excellent above average average below average poor

Remarks

This is definitely one of the better PhD-theses I have read in the last decade. The topic is also of great interest to my own work and the work of my students.

Final assessment of the doctoral thesis

The thesis is of very high quality, both of scientific content and also the structure.

Following a successful defence of the doctoral thesis I recommend the granting of the Ph.D. degree

yes no

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Opponent's signature:  TU Delft