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Opponent's review of the Doctoral Thesis

Candidate Tomáš Hána

Title of the doctoral thesis Time and Temperature Dependent Shear Stiffness of Polymeric Interlayers and its Effect on Laminated Glass in Bending

Study Programme Structural and Transportation Engineering

Tutor associate professor Martina Eliášová, dr. Miroslav Vokáč

Opponent professor Jaroslav Kruis

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Topicality of the doctoral thesis theme

Commentary: Laminated glass is used in connection with contemporary architecture. In comparison with other materials, the laminated glass is not understood enough and it requires an attention. The dissertation submitted is concentrated on experimental and numerical analysis of the laminated glass and several new results are obtained.

☐ excellent	☒ above average	☐ average	☐ below average	☐ poor

Fulfilment of the doctoral thesis objectives

Commentary: The applicant fulfils all objectives summarized in Section 4. All experiments are well described in details and numerical simulations are also well documented which is certainly not standard. The finite elements and material models used are clearly described which enables a possibility to repeat the simulations in future.

☐ excellent	☒ above average	☐ average	☐ below average	☐ poor

Research methods and procedures

Commentary: Many laboratory tests were executed in order to obtain data for determination of parameters in numerical models. I highly appreciate relatively high number of samples used which can lead to relevant statistical description of material parameters. This is extraordinary attitude. The applicant used RFEM and Ansys for numerical simulations.

☒ excellent	☐ above average	☐ average	☐ below average	☐ poor

Results of the doctoral thesis – dissertant's concrete achievements

Commentary: The applicant summarized the main outputs in Section 12. The shear stiffness dependent on time and temperature was described for PVB materials. The results were published in international reviewed journals and in international conferences indexed in the database Scopus. The work has been cited several times in relatively short period which leads to an assumption that many citations are expected in future.

☒ excellent	☐ above average	☐ average	☐ below average	☐ poor

Importance for practice and for development within a branch of science				
Commentary: The thesis submitted brings many new results which can be used in formulation of a code for laminated glass. There are clear suggestions for experimental tests and numerical simulations in engineering practise.				
☒ excellent	☐ above average	☐ average	☐ below average	☐ poor

Formal layout of the doctoral thesis and the level of language used				
Commentary: The applicant described clearly the state of the art, all laboratory tests performed and all numerical simulations. The thesis is written in well English. There is a list of symbols used, list of abbreviations and detailed table of content.				
☒ excellent	☐ above average	☐ average	☐ below average	☐ poor

Remarks

There are only minor objections. For example, on page 23, the unit of the universal gas constant is J/mol/K, not J/mol.K. This mistake can be found elsewhere.

I am not happy with references to equations which follow after several lines.

In text, arguments of functions have to be written in the mathematical style, i.e. in italic.

On page 43, there is a statement that a one 3D hexahedron finite element in vertical direction is used. The applicant has to comment this. I remind, a linear distribution of strains and stresses occurs in beam theory while the hexahedron element leads to constant strain and stress. Therefore, several elements have to be used in order to describe the actual strains and stresses.

Page 109: some vectors are indicated by bold letters but some are not. It complicates reading of the thesis.

I did not find any damage model connected with glass plates. The glass is a brittle material. Why a damage model has not been taken into account?

The shear modulus is determined with respect to a given temperature. Is there a possibility to change any material parameters with respect to the temperature which is changing in time?

Final assessment of the doctoral thesis

I strongly suggest the thesis for defence. My questions and suggestions definitely do not decrease the very high quality of the thesis.

Following a successful defence of the doctoral thesis I recommend the granting of the Ph.D. degree		
	yes ☒	***no*** ☐

Date: 12 April 2022

Opponent's signature: .....