

Doctoral thesis review

Thesis subject: **Kinetic Study of Selected Combustion Process**

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Reviewer: **Prof. Eng. Pavel KONEČNÝ, Ph.D.**

Doctoral thesis contains 137 pages and is logically divided into 4 chapters. It contains all necessities required on the dissertation thesis. The subject of thesis is highly actual for further development of the rocket solid propellants.

Student sets a goal of thesis – to test the ability of preparation and testing of cast double base propellant including some energetic plasticizers, BuNENA and DNDA57 and some other energetic fillers, RDX, BCHMX and AP.

The theoretical part introduced in 1st chapter contains the aim of thesis, processes of manufacturing and determination of basic properties of the selected propellants.

The experimental and calculation part is described in 2nd chapter and discussed in 3rd chapter. Compositions preparation is described in detail in parts 2.2 and 2.3, and again discussed in parts 3.2 and 3.3. Equations 2.1 to 2.5 (part 2.4, pages 63 to 64) and their description repeat unnecessarily in part 3.4.4 (pages 88 and 93). The parameter A_t is described in the list of symbols as nozzle throat area (its unit has to be mm²). Its unit in table 2.6 (page 67) is wrongly mm. The same mistake is used in text and in figure 3.31 (page 105)

Qualities of thesis are in

- preparation of 10 compositions of cast modified double base propellants using RDX, BCHMX and AP as energetic fillers and BuNENA-DNDA57 energetic combine plasticizer and preparation of 3 compositions of composite solid rocket propellants based on AP and HTPB with 3 various burning rate catalysts.
- The thermal decomposition kinetics and the heat flow properties of all prepared samples were tested using differential thermal analysis and differential scanning calorimetry. Results of these test and calculations are significant.
- the burning rate measurement has been carried out, but in the closed vessel only.
- Sensitivity to impact and vacuum stability tests have been carried out with the samples of cast modified double base propellant samples and discussed.

Partial drawback can be in the part 3.5.2 and 3.5.3, where the burning rate measurement and effect of initial temperature have been tested on commercial extruded DB propellants only.

Thesis is elaborated in the required quality. The goal of thesis has been fulfilled. Obtained results are based on a sufficient amount of experiments.

The Summary of the doctoral thesis corresponds to the main characteristics of thesis and it is possible correctly to deduce the main contribution of student for the development of the field of study.

Doctoral thesis is the original work of student. All references used in thesis are correctly denoted.

Number of student's publications related to the thesis is sufficient. Student is author of 3 papers in the international journals. He presented results of his work on 3 international conferences.

The formal level of text is very good except several mistakes in sentences, which make the text locally less understandable.

Question for defence:

1. Why didn't you measure the burning rate of prepared composition samples in other ways than in closed vessel?
2. Could you estimate specific impulse of prepared compositions?

Conclusion

Doctoral thesis of Ahmed Maraden, MSc. completes the conditions introduced in §47, clause 4 of the University Act. Student proved the ability to the individual scientific work. He brings the new pieces of knowledge in thesis for further development of scientific branch.

I recommend to submit the doctoral thesis to the dissertation defence.

Brno, October 23, 2018


Prof. Eng. Pavel Konečný, Ph.D.