Supervisors opinion on thesis – Ing. Hua Tan

CEITEC VUT 2020 Ph.D. student: Ing. Tan Hua
Study program: Pokročilé materiály a nanovědy
Supervisor: doc. David Salamon, Ph.D. (Innovative technologies for ceramics)
Thesis: Extremely fast sintering of advanced ceramic materials

Ing. Hua Tan joined CEITEC as a Ph.D. student in Brno from December 2015 and his research topic was focused on extremely fast sintering. The research topic required advanced research review as well as practical skills to operate the Spark Plasma Sintering (SPS) apparatus.

The present thesis has four parts focused on open scientific questions and use the SPS technique to find the answers. Firstly, the investigation of the “Field effect” in SPS is based on the clever design of the experiments supported by theoretical calculations. Both experimental results and theoretical calculations demonstrated that the negligible impact of electromagnetic field during SPS.

Secondly, the investigation of the pulse pattern effect demonstrates the possible advantage of pulsing direct electric current in energy saving. The Ph.D. candidate also addresses new research questions and possible applications for further investigation.

Thirdly, the pressure timing effect was investigated based on the original Ph.D. candidate’s observation. Experimental data support the described relation between pressure and vapor, leading to the different vapor transfer rate of the first sintering stage. Furthermore, the promotion of diffusion can enhance densification during the second sintering stage.

Fourthly, practical application of the direct Joule heating on the electrically conductive samples by direct electrical current passing was tested on boron carbide ($\text{B}_4\text{C}$) and its composites. Microstructure and mechanical properties after SPS were investigated and the candidate explained mutual relations. This part of the thesis was directly intended for industrial applications within the running project, and the Ph.D. candidate met the requirements of the project schedule.

In summary, Ing. Hua Tan gained a broad knowledge of his research field, demonstrated the ability of independent scientific work, and achieved many original results. Therefore, I recommend his dissertation thesis to be accepted for defense.

Brno, 22. 5. 2020

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doc. David Salamon, Ph.D.