

TO WHOM IT MAY CONCERN

your reference:

Email Petra Hájková- 27 July 2021

our reference

EA17/GVOost/2021/ MSc thesis Čečrdle 18/08/2021

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Evaluation of the Diploma thesis of Jan Čečrdle, entitled “Simulation of behavior of liquid metal heat shield on the tokamak COMPASS Upgrade”.

The topic of this MSc thesis is quite relevant for fusion research. The success of magnetic fusion reactors strongly depends upon handling the challenging issues of power and particle exhaust. Tungsten is widely used in existing fusion devices for plasma facing components (PFCs) and will be used in the ITER divertor. However, even in the absence of neutron irradiation, conventionally available tungsten suffers from cracking due to its high ductile-to-brittle transition temperature (DBTT), and it is estimated that the thermal load limit for a solid tungsten divertor is ~ 5 to $20 \text{ MW}\cdot\text{m}^{-2}$, which is almost an order of the magnitude lower than what is expected in a 3 GW fusion reactor. Growing efforts are thus being devoted to the development of advanced tungsten-based materials. An alternative to solid plasma facing components is the use of liquid metals such as lithium or tin. Liquid metals offer the benefits of the self-healing properties of liquid surfaces and the possibility of in situ replacement of surfaces exposed to the plasma by capillary forces. However, compared to solid materials PFCs, liquid metal PFCs are far less investigated in the fusion community. Within the EUROfusion research programme, liquid metal PFCs will be investigated on the tokamak COMPASS-U, and the present thesis focuses on simulations of the liquid metal heat shield behavior in COMPASS-U and the ALIMAT-F device.

The methodology and procedures followed in this thesis are sound and sufficiently in-depth. The results obtained are important for the future scientific programme of the COMPASS-U tokamak and for the EUROfusion programme in general, and good suggestions for further work are given. However, in my opinion the planned experiments on ALIMAT-F are not so useful for the investigation of the behavior of liquid metal PFCs in future fusion devices.

Abstract and conclusions are clear. Layout: structure, language, figures & tables, and page layout are quite good.

This diploma thesis convincingly shows that the candidate is capable of independent and productive scientific work, and has all the necessary qualities to become a first class researcher.

Proposed quotation: A (Excellent)

Some minor English grammar mistakes

Page 26, line 3 after Fig.1.10 : stripped

Page 45, line 4. ...plasma. Stannane...

Page 47, line 6: For heat fluxes

Page 56, line 2 after Fig.3.1: for instance

Page 63, : See Section ??

Page 75, line 2: characteristic

Page 80: replace excessive research by extensive research

Prof. Em. Dr. ir. Guido Van Oost