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MELTING DYNAMICS FOR DIFFERENT MATERIALS IN INDUCTION COLD CRUCIBLE: NUMERICAL SIMULATIONS COMPARISONS WITH EXPERIMENT

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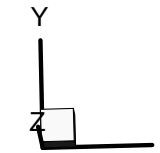
Dynamic melting simulation:

- *Some validation results: power loss and temperature measurements at Birmingham ISM*
- *TiAl melts*
- *Dome height measurements vs simulation*
- *Al melts*
- *Si melts*
- *External DC field effects*

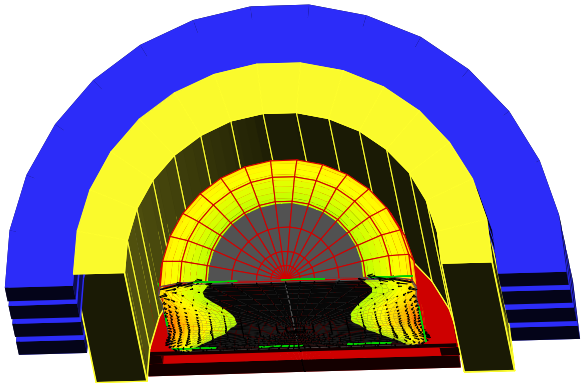
Melting Al, stage: 1

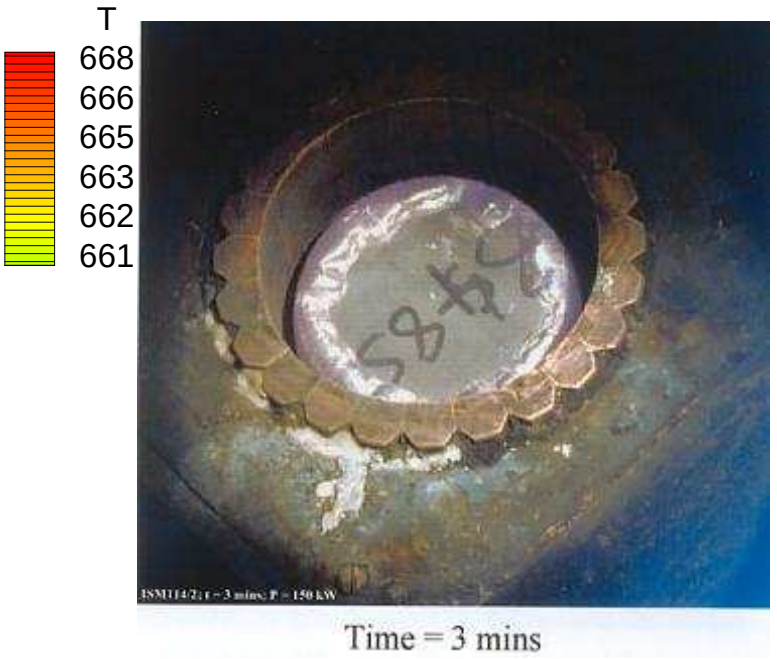
I =5560 A , f=7000 Hz, Idc=0
el.conduct Al = 4850000.



0.5 m/s

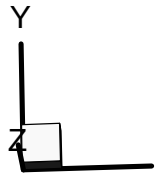
4 coil turns



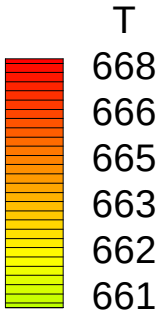


Melting Al, stage:2

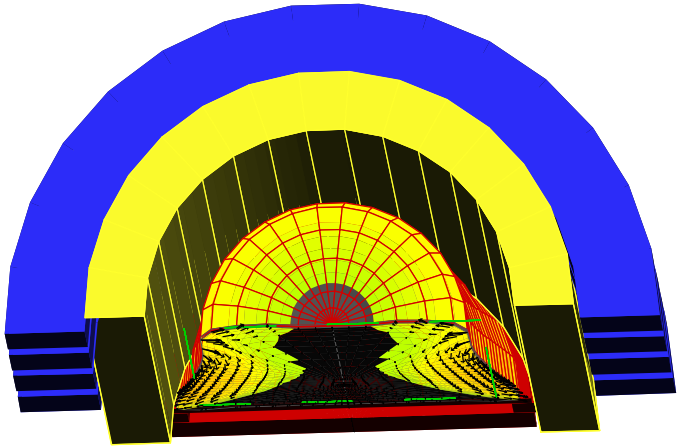
I =5560 A , f=7000 Hz, Idc=0
el.conduct Al = 4850000.

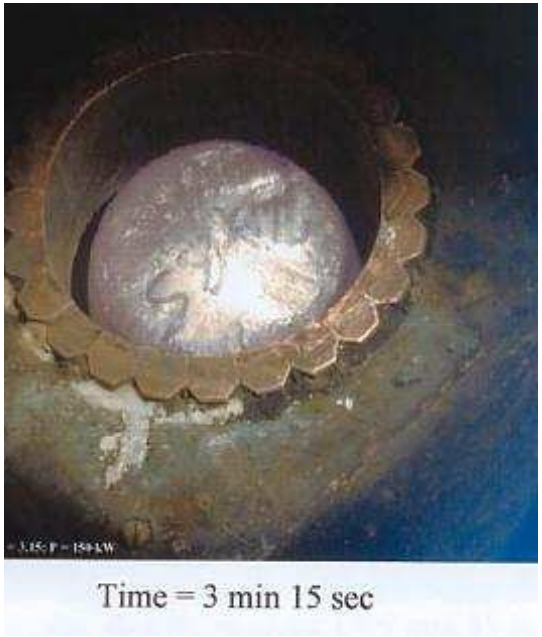


0.5 m/s



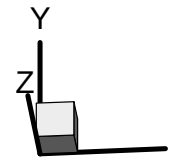
4 coil turns




Time = 3 min 15 sec

Melting Al, stage:3

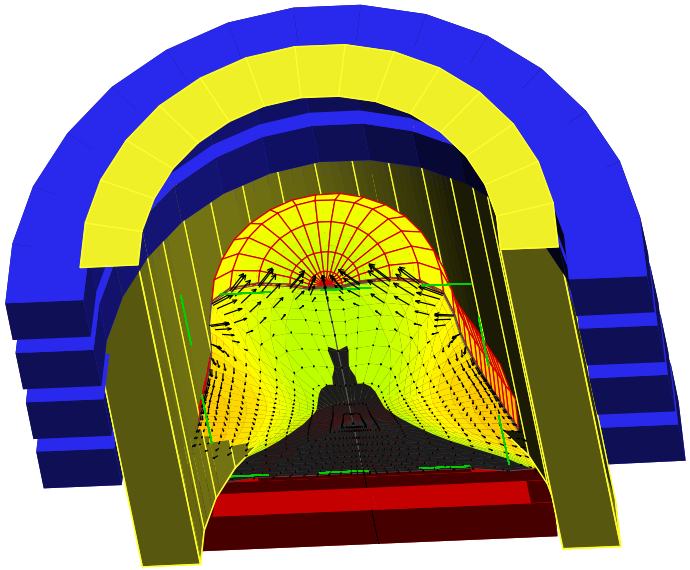
I =5560 A , f=7000 Hz, Idc=0
el.conduct Al = 4850000.



0.5 m/s

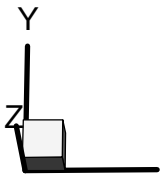
T
668
666
665
663
662
661

4 coil turns



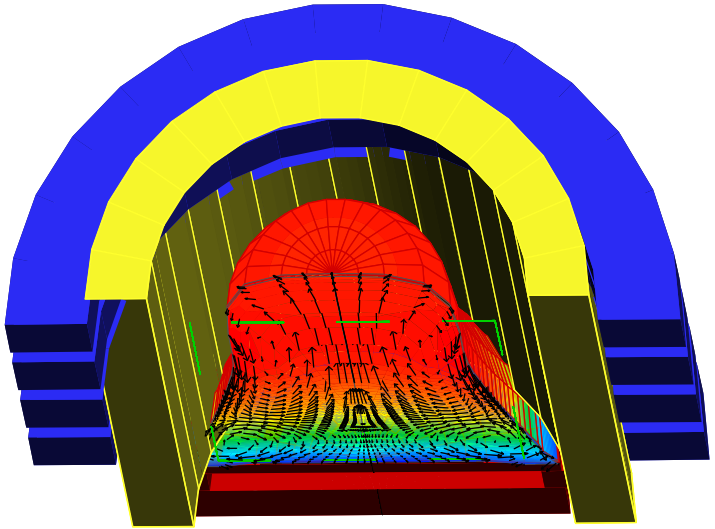
Melting Al, stage: 5

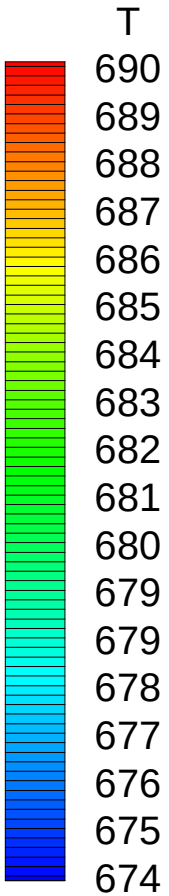
I =5560 A , f=7000 Hz, Idc=0
el.conduct Al = 4850000.



0.5 m/s

4 coil turns

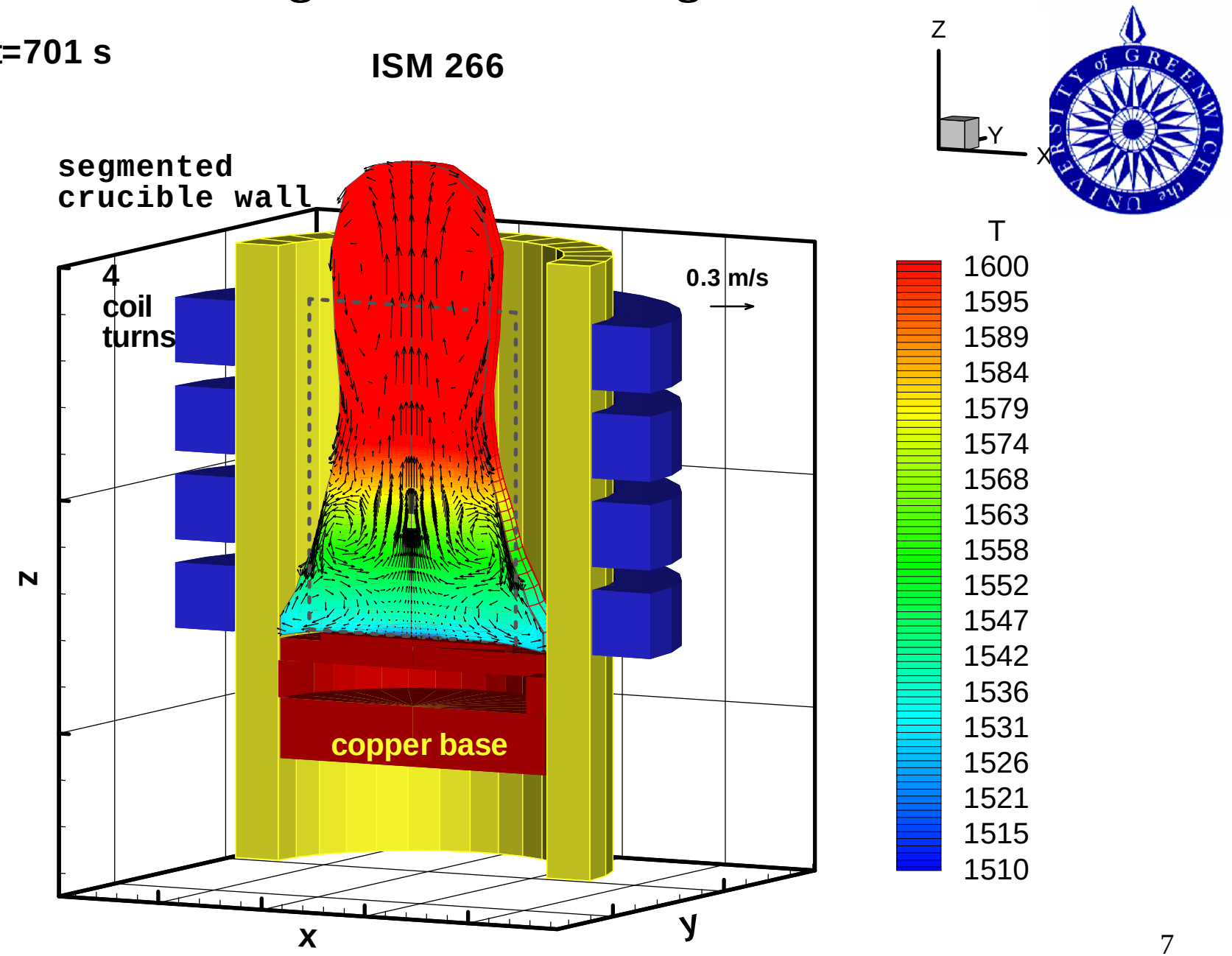




Birmingham ISM: melting TiAl

t=701 s

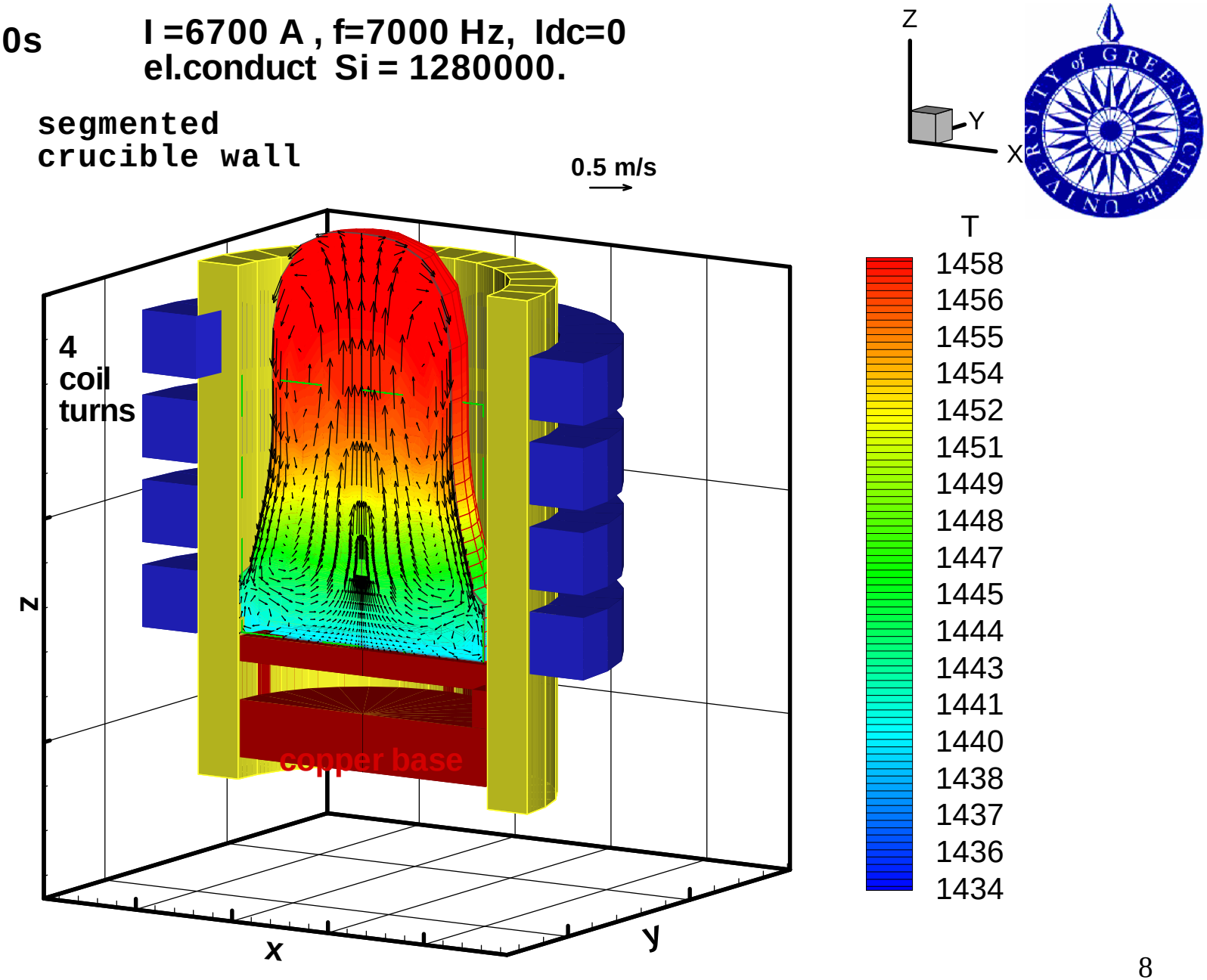
ISM 266



Melting Si

t=600s

I =6700 A , f=7000 Hz, Idc=0
el.conduct Si = 1280000.



Conclusions

- We introduce a truly dynamic model of the magnetically confined interface evolutions as applied to the melting and similar processes
- The simulations are validated against observations on the semi-commercial ISM crucible
- Low energy efficiency of the cold crucible technique can be partly improved by additional DC magnetic field

  (**faster, more stable and higher superheat**)
- The codes are sufficiently universal to adapt them to other applications for electromagnetic material processing