



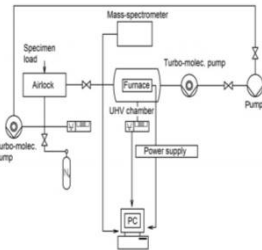
SUMMARY OF RESEARCH

The high precision assembly of accelerating structures requires a high quality diffusion bonding. The best bonding between the segments can be achieved in the presence of hydrogen atmosphere since it protects the surface from the oxidization. The effect of hydrogen on copper surface quality and hardness of copper samples will be studied in detail to understand the mechanism behind the vacuum breakdown in accelerating structure. Towards first objective Hydrogen thermal desorption spectroscopy is used to study the behavior of hydrogen in copper structure undergone thermal cycle. During measurements it has been found that 2 to 5 ppm hydrogen is present in the copper specimens while results theoretical diffusion model says that there should not be any hydrogen left after the heat treatment. Which indicates that during this extensive heat treatments increase in vacancies in copper along with hydrogen diffusion creates traps or voids and understanding of their dynamics is next immediate goal.

THERMAL DESORPTION SPECTROSCOPY

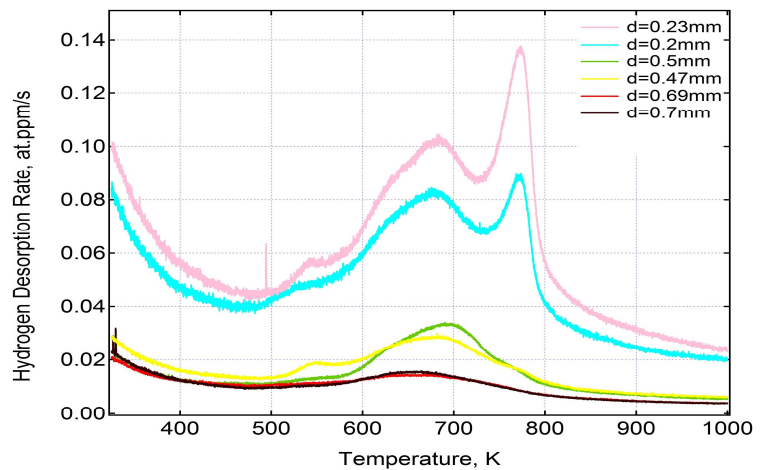


General view and scheme of TDS apparatus

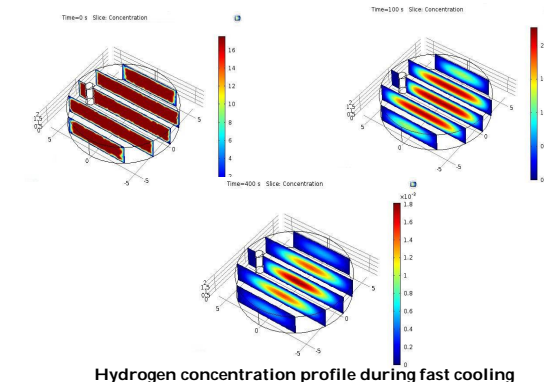
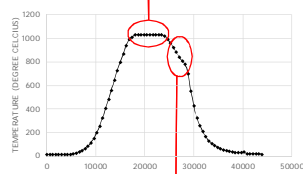
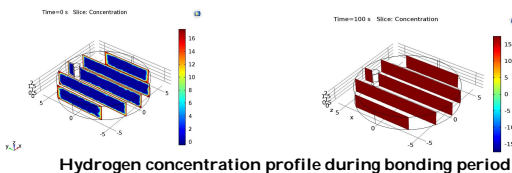


The basic vacuum in UHV chamber is kept at the level of 7×10^{-9} mbar. The heating system provides a direct control of the specimen temperature in the temperature range from room temperature to 1273 K with heating rate from 1 to 10 K/min. Typical size of TDS specimens is $0.9 \times 4.0 \times 14$ mm

TDS RESULTS

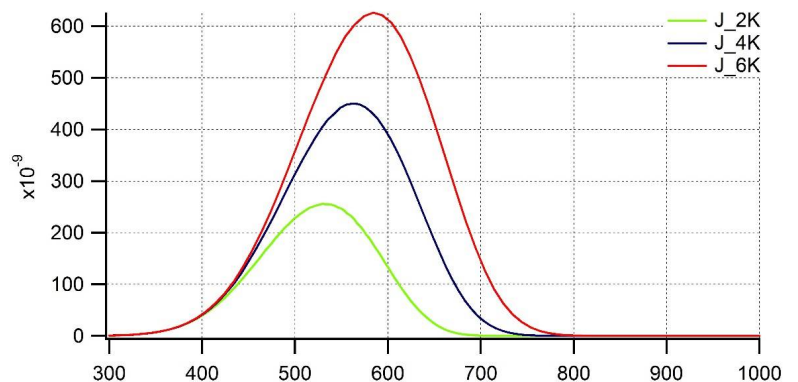


SIMULATIONS



TDS SIMULATIONS

Concentration simulations says that hydrogen diffuses uniformly at 1298 K and during fast cooling due to higher diffusivity it should diffuse out fully. But measurements shows some amount of hydrogen which is assumed to be trapped in trapping sites. Assuming homogeneous hydrogen charged copper specimen and using diffusion model TDS peak have been model for different heating rate. This can set basis for calculating trapping and detrapping energies.



CONCLUSION

- Results suggests that thermal cycling process in presence of hydrogen might create voids/vacancy clusters beneath the surface
- For heating rate of 4K per minute diffusion peak is around 600K while experiments have peak at 700K
- TDS with 0.2 mm thickness shows dual peaks with higher magnitude suggesting that surface may have higher void density

REFERENCES

[1] W. R. WAMPLERT, T.SCHOBER and B. LENGELER....and many more