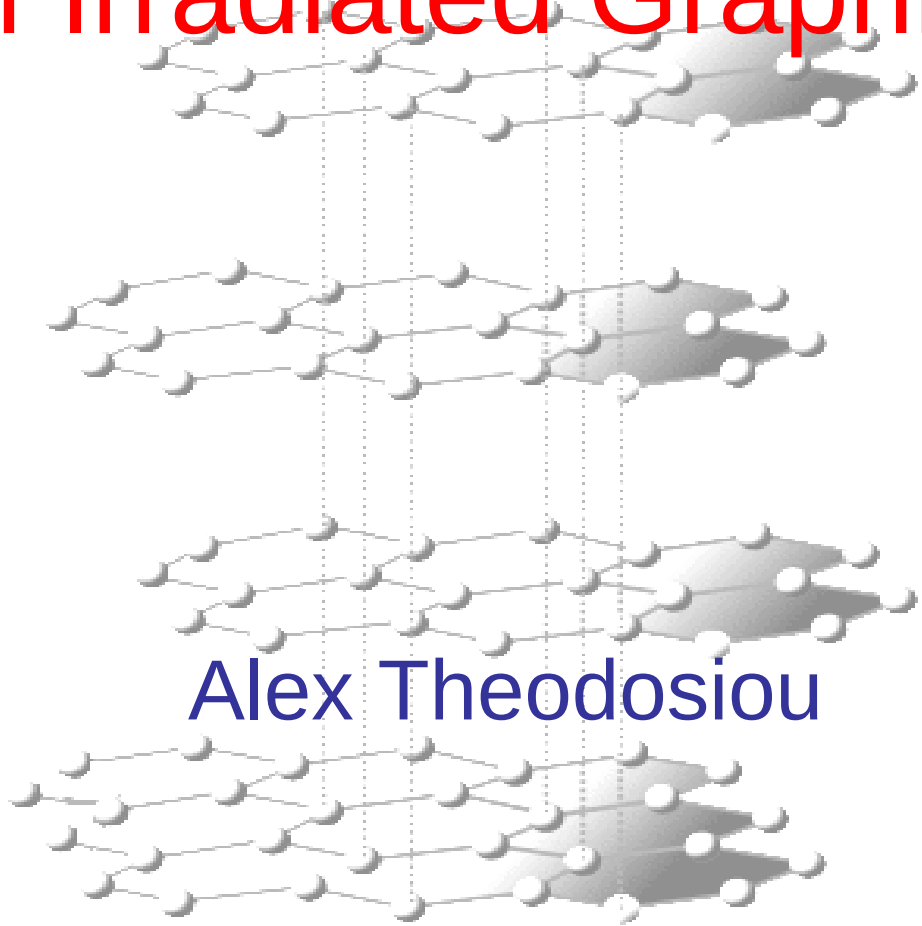
Simulation of Irradiated Graphite



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Aims

- Simulation of irradiated graphite through bombarding graphite with inert gas ions under ultra high vacuum (UHV).

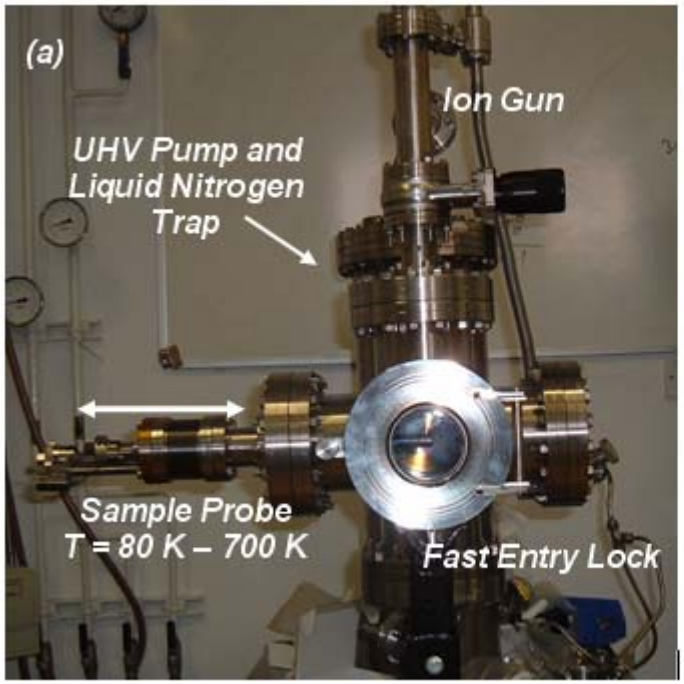
- Does Ion bombardment cause lattice distortions leading to Wigner-like stored energy?

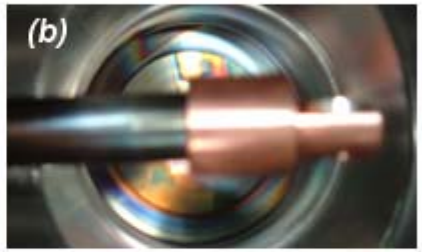
- This would allow us to simulate the stored energy phenomenon that occurs within nuclear reactors during neutron irradiation.

- Use analytical techniques, both structural and characteristic, to explore the nature of this stored energy and the effect of ion bombardment on the graphite lattice.

Apparatus

Particulate reactor grade graphite, supplied by BNFL, is used and irradiated with Ar^+ ions under UHV.





a) The UHV apparatus

b) Close-up of the sample probe and holder

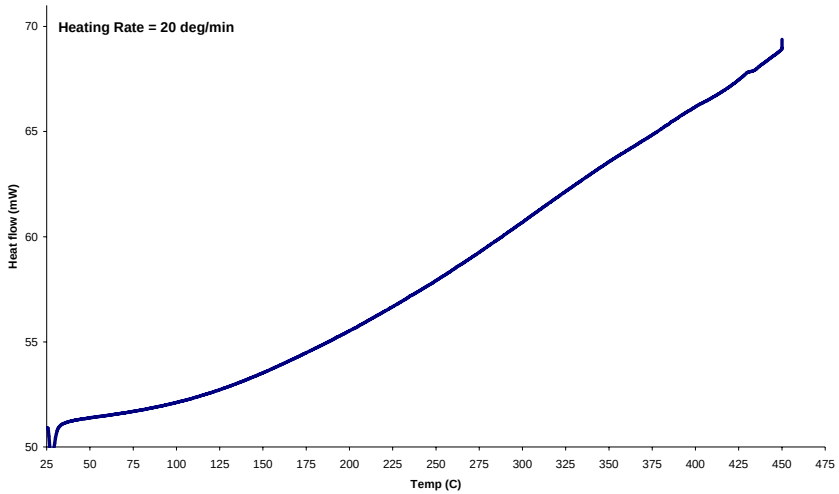
System was custom built at Cardiff and uses a diffusion pump to reach pressures down to $3x10^{-10}$ mbar.

- Once sample is loaded it is bombarded with Ar^+ ions.
- Each experiment involves a different set of parameters.
- Aim is to find optimum set of parameters that will lead to maximum irradiation damage to graphite lattice.
- DSC is utilised in order to detect the build up of stored (Wigner) energy, within the graphite samples after ion bombardment.

Differential Scanning Calorimetry (DSC)

DSC is utilised in order to detect the build up of stored (Wigner) energy, within the graphite samples, after ion bombardment.

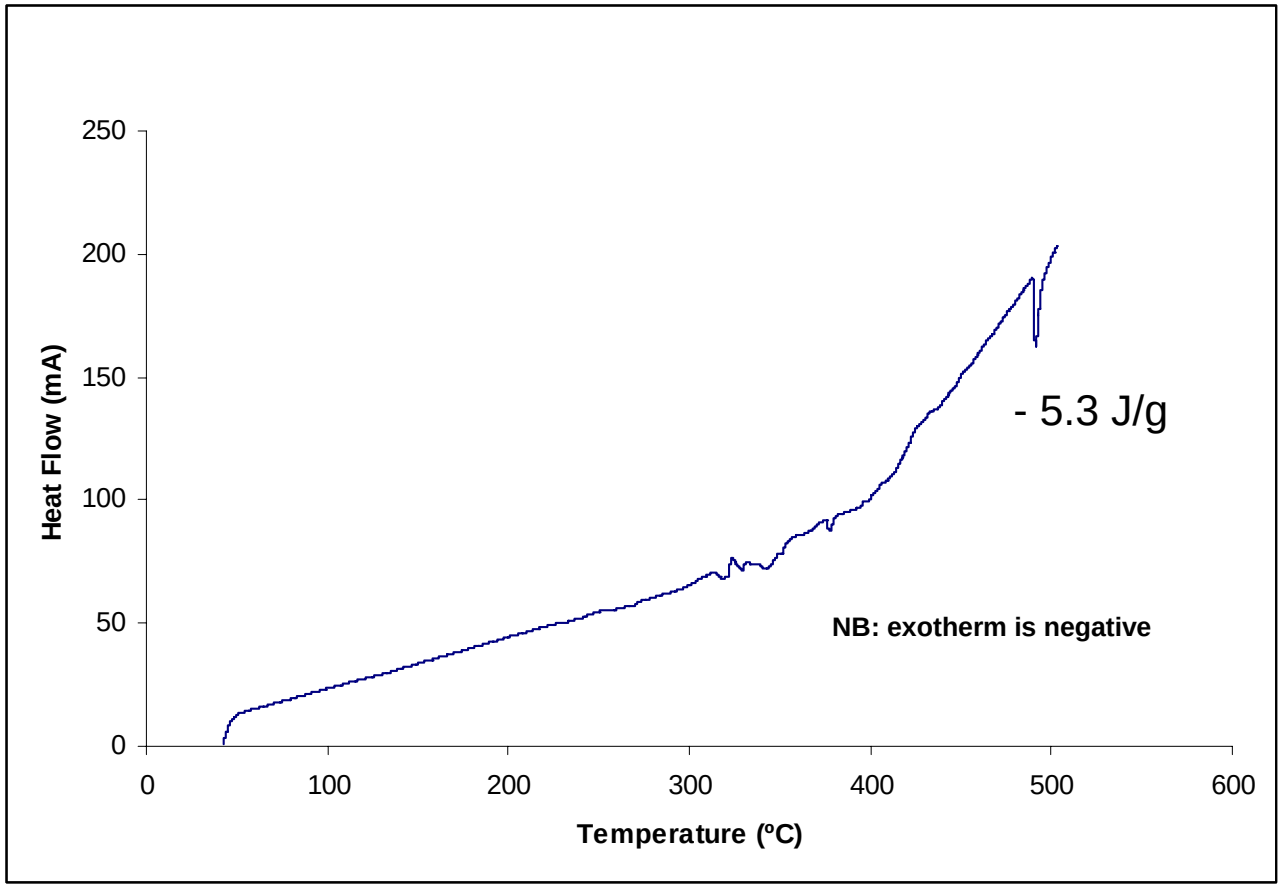
Perkin-Elmer Diamond DSC with N2 supply



DSC trace of virgin graphite – no peaks observed

The above DSC machine has been obtained from the EPSRC loan pool for use in this project.

An example of a DSC trace obtained at Cardiff, showing a distinct exotherm, is shown below:



Indicates the presence of stored energy (Wigner?)

- DSC experiments carried out so far have shown promising results.

- Need to continue experiments and try to find optimum parameters for the generation of Wigner-like stored energy.

- The effect of different inert gas ions (He^+, Ne^+, Xe^+) will also be investigated.