D_2 Fusion in Ionic Solid + Nanometal Composite

Talbot A. Chubb
Physicist Consultant, Arlington, VA

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Notes by T. A. Chubb

Interfaces between Ionic Solids and Nanometals

- Provides 2-dimension lattice symmetry
- Promotes Bloch deuterium
- Deuterium quasiparticles undergo fusion

$$D^{+}_{Bloch} + D^{+}_{Bloch} \rightarrow {}^{4}He^{++}_{Bloch}$$

- These 3 phenonomena are well established by experiment
- I think that they all are a result of a single principle that is implicit in Bloch-function physics, namely, coherent partitioning

Plasma Fusion vs. Cold Fusion

- Roughly equal integrated energy output
- Plasma fusion: $<1.6 \times 10^7$ J

  C. Cookson, *Financial Times*, p. 14 (9 Nov. 2007)
- Cold fusion: 1.4×10^7 J

  Y. Arata and Y-C Zhang, *Proc. Japan Acad.* **78B,** p. 57 (2002)

- Bloch-function particles have non-random phases
- 2-particle wave function has 6 degrees of freedom
- Bloch representations in lattice space and separation space are both modulo a lattice vector
- Coulomb work in bringing ions into nuclear contact is reduced by coherent partitioning

Ionic Solid + Nanometal Composites

- Absorb abnormal amounts of hydrogen

  Absorption measured by time history of pressure rise during hydrogen flow into known reservoir volume containing known amount of nanometal at constant flow = **20 cc-atm/min**

Next slide shows results with:

Bulk Pd: pressure rise delay = 1 min

Pd-black: pressure rise delay = 12 min

ZrO_2 + nanoPd: pressure rise delay = 16 min

ZrO_2 + nanoNi,Pd alloy: pressure rise delay = 30 min

- Charge density partitioning reduces the work required to push 2 deuterons into nucleus-nucleus contact
- Because less energy is expended by the strong force interaction doing this Coulomb work, the nuclear product is more exothermic than for the non-partitioned configuration.
- Therefore the Bloch-configuration product is in a lower energy state than the non Bloch-partitioned product.

Nanopowders: P vs. time Curves

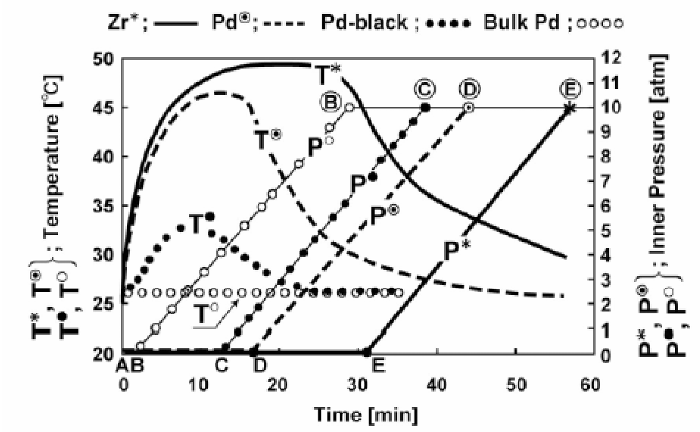
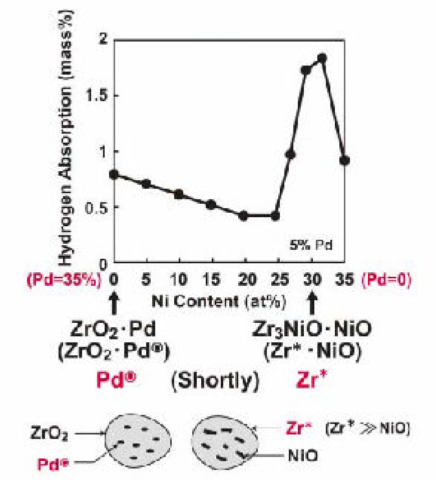


Fig. 4 Deuterium absorption characteristics of sample powders ; $Zr_3NiO \cdot NiO$ (Zr* · NiO), $ZrO_2 \cdot$ Pd($ZrO_2 \cdot$ Pd®), Pd black and bulk Pd.

6:1 Ni:Pd Alloy Best Absorber



Where does hydrogen go?

•Yamaura et al. favor region near ionic crystal nanometal interface

Yamaura et al., *J. Mater.Resersch* **17**, 1329 (2002)

• Epitaxy-fit interface layer hosts quasiparticle deuterium

• Bloch sensitivity makes E_{nuc} a function of N_{well}

• Summed embedded ion + lattice energy is function of N_{well}

• Phonon fluctuations that increase N_{well} lower total energy. Amplitudes of favored phonons grow by nuclear energy release, transferring nuclear energy to the lattice

• Any nuclear configuration changs which does not change nucleus energy is resonant and occurs on a nuclear time scale. (No energy transfer to lattice)

A & Z Oxidized Nano-powders

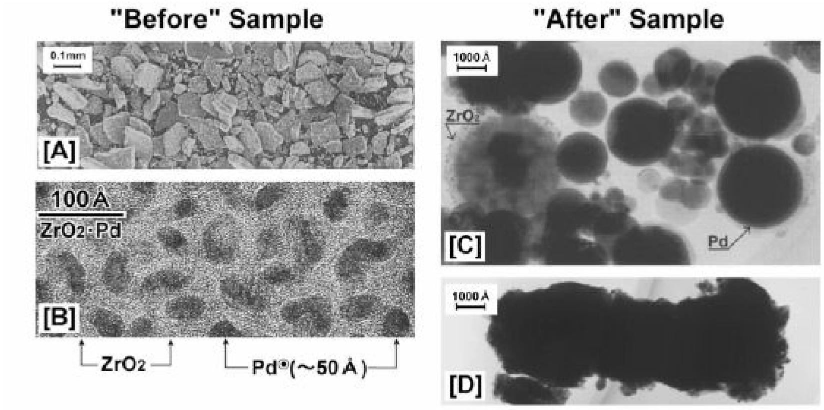
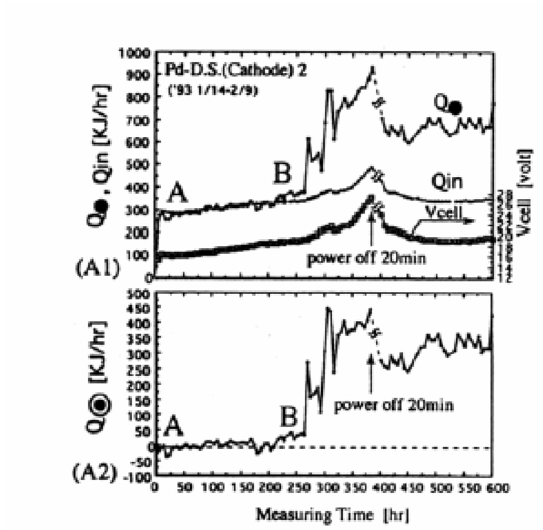


Fig. 6 Photomicrograph [A] and electron micrographs ([B], [C], [D]) of characteristics and its change of the sample powder ($ZrO_2 \cdot Pd^{®}$) using laser welding nuclear fusion system.

Arata and Zhang First Excess Heat



Cold Fusion Heaters

- Ionic crystal + nanometal provides a likely road to cold fusion heaters
- If deuterided ZrO_2 + nanoNi provides as much heat as deuterided ZrO_2 + nanoPd, cold fusion heaters will be commercial
- If nanometal cold fusion research is reasonably supported, cold fusion heaters are a near term option

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- Any nuclear configuration changs which does not change nucleus energy is resonant and occurs on a nuclear time scale. (No energy transfer to lattice)