IH Ref: IH-017-Prov

In-Situ LENR Breeder Reactor

TECHNICAL AREA:

The material type, size, and presence of vacancies/defects in a metal lattice, as well as the presence of vacancies/defects in a metal lattice, as well as the presence of hydrogen or deuterium are significant contributing factors to an exothermic reaction. This disclosure describes reactor systems that create the necessary material conditions for an exothermic reaction in-situ, rather than the typical reactors that perform material preparation outside of the reactor system and then insert the prepared material into the reactor to then be triggered.

BACKGROUND:

Current exothermic reaction systems have two strong requirements:

(1) Materials require preparation to achieve very specific characteristics such as vacancies, grain boundaries, or surface area.
(2) The reaction is triggered by applying a voltage, temperature, pressure, and/or magnetic field to the materials.

Current reactors perform material preparation before reactor system assembly. The proposed method allows for the material preparation to create the necessary characteristics (surface area, vacancies, etc) to be performed in-situ within the reactor system, rather than having the extra step of preparing

EXISTING TECHNOLOGIES:

Existing exothermic reaction systems require material preparation to create the fuel material before assembling the reactor. Some examples of this include:

- Plating the wall of a reactor container with the material of interest and sing techniques such as electro-plating to create a bumpy surface for increased surface area
- Ball milling a material to create nanoparticles with sufficient surface area and then oxidizing to create vacancies before inserting material into the reactor vessel
- Purchasing nanoparticles with sufficient surface areas and then performing processes such as oxidation or other to create vacancies.

PROBLEMS WITH EXISTING TECHNOLOGIES:

The existing technologies require that material preparation be done before the reactor is assembled. The material is then moved into the reactor, or it is plated to be wall of the reactor and the reactor is assembled.

The invention disclosed allows for materials to be placed in the reactor as-is. The reactor's triggering process can then include a stage of material preparation so that the material reaches a state where it can then be triggered by the temperature, pressure, magnetic field, or other to begin the exothermic reaction.

SUMMARY OF THE PROPOSED SOLUTIONS

The proposed solution combines material preparation and triggering into the reactor system. This could help eliminate contamination of materials between external material preparation and inserting into the reactor. The could also help bring down cost, as external material preparation can require expensive machinery such as cryo mills, ovens, or purchasing nanoparticle material.

DETAILED DESCRIPTIONS

Figure 1 is a proposed example embodiment of performing material preparation in-situ within the reactor system, after assembly. A nickel mesh can be placed in contact with a stainless steel metal container. In this case, it is a cylindrical metal container. The nickel could also be sputtered onto the inside wall of the container to create a nickel surface with a lot of surface area. In either case, the nickel and the container should be connected electrically.

A nickel electrode wrapped with a Palladium wire is inserted down the center of the reactor and is electrically isolated from the reactor container. The reactor container will have minimally a gas inlet/outlet, which could be the same opening or 2 openings. A high voltage can be applied where the positive side goes to the electrode and the return goes to the reactor container.

Once the reactor is fully assembled, material preparation can begin. (Figure 2) After removing any contaminants through vacuum, heat, gases, or a combination, then a vacuum can be drawn. Deuterium can be flowed into the reactor at a low pressure. A high voltage is placed on the electrode so there is a significant voltage differential between the electrode and the reactor wall. This voltage can be AC or DC, and is minimally 1000V in this embodiment. The pressure, temperature, and voltage differential cause a plasma within the reactor. This causes nanoparticles of Palladium from the wire around the electrode to be inserted onto the nickel on the outer wall of the reactor. Deuterium can also be captured within the nickel on the outer wall.

Once all deuterium is used up, which can be determined by the color of the plasma or possibly by reading the reactor pressure, then there are enough nanoparticles of Palladium and trapped Deuterium on the outer nickel wall that the material is ready for an exothermic reaction. At this point, the high voltage can be removed.

The reactor can now be triggered to begin an exothermic reaction by using temperature, pressure, magnetics, or other known methods of triggering the reaction, dependent on the specific type of reactor.

Figure 2 illustrates an example process for preparing an exothermic reactor. In that process, reaction materials are generated inside the reactor during the preparation process. First, the reactor is assembled using appropriate materials. Then a vacuum is pulled inside the reactor to at least $10^{-3}\ Torr$ before deuterium is added to the reactor. In one embodiment, the pressure of the deuterium is in the range of 1 to 3 Pascal. After the deuterium is added to the reactor, a high voltage is applied to initiate plasma. In one embodiment, the voltage ranges from 200 – 1200 V. The power may be AC or DC. In one embodiment, the plasma initiated inside the reactor is the so-called glow discharge and the color of the glow discharge can be used to determine whether the preparation process is finished and the reactor is ready.

Figure 3. This is another example embodiment of a reactor where material can be prepared within the reactor. The material selected in this reactor is more important as it is a metal hydride, metal deuteride, or metal oxide. Metals may include Lithium, Nickel, Palladium, or other known metals used for exothermic reactions.

After the material is placed in the reactor, the material is prepared by heating the reactor to a temperature high enough for the material to expel the trapped hydrogen, deuterium or oxygen. The reactor must be able to withstand high pressure so the gas remains trapped in the reactor, and should only be able to be removed by vacuum by the user. As the hydrogen/deuterium/oxygen leaves the metal, vacancies and defects remain within the metal, which are required for the exothermic reaction later.

In the case of using oxygen, the metal may be re-exposed to oxygen to re-create an oxide and then the oxygen may be expelled again to create additional defects. In the case of hydrogen or deuterium, the gas may be used again to help trigger the exothermic reaction but may not be expected to reform in to a hydride or deuteride with the metal.

After the gas is expelled, another mechanism such as temperature, pressure change (higher pressure or vacuum), magnetics, or voltage may be used to trigger the exothermic reaction.

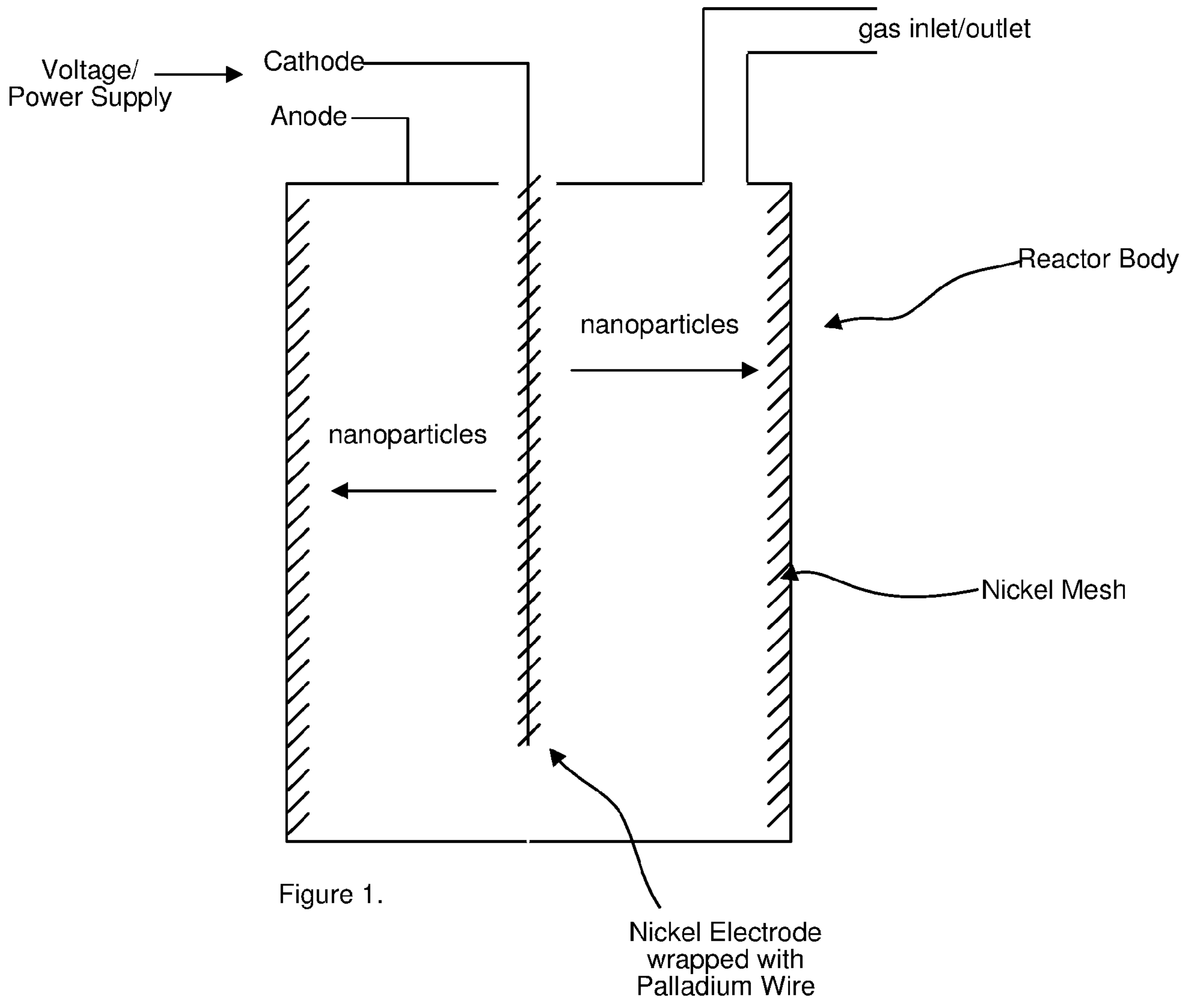
gas inlet/outlet
Voltage/
Power Supply
Cathode
Anode
Reactor Body
nanoparticles
nanoparticles
Nickel Mesh
Nickel Electrode
wrapped with
Palladium Wire

Figure 1.

Figure 2.

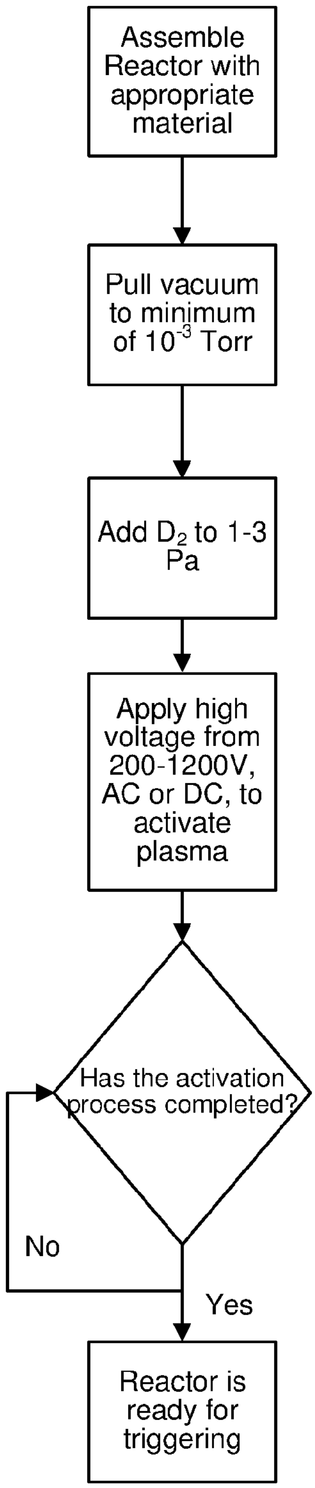
Assemble Reactor with appropriate material
Pull vacuum to minimum of 10^{-3} Torr
Add D_2 to 1-3 Pa
Apply high voltage from 200-1200V, AC or DC, to activate plasma
Has the activation process completed?
No
Yes
Reactor is ready for triggering

Figure 3.