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Ring Plating Methods

TECHNICAL AREA:

The present disclosure relates to methods for producing thermally reactive surfaces inside a tubular reaction chamber, typically made of metal.

BACKGROUND:

Different types of exothermic reactors have been commercially available to generate energy and produce heat. New exothermic reactors using new physical processes are currently being researched and developed. One class of these reactors involves a metal tube with reactive metal plated electrochemically on its interior walls. After the sidewalls are plated with a hydrogen-absorbing material, the interior of the tube is pumped to high vacuum and then filled with deuterium gas at sub-atmospheric pressure. High voltage is applied to the electrodes, the purpose of which is to ionize the deuterium and drive it into the plated sidewalls where conjectured heat-producing reactions can occur.

EXISTING TECHNOLOGIES:

The method commonly used is to plate the tube walls using electrochemical methods. Typically palladium chloride is added to H_2O in the tube and the tube is grounded negative electrically. A platinum wire anode is inserted into the electrolyte containing the $PdCl_2$. The anode is positive. The palladium is then plated to the sidewalls to form a hydrogen-absorbing surface to host heat-producing reactions involving deuterons.

PROBLEMS WITH EXISTING TECHNOLOGIES:

The process is inherently slow and could not keep pace with a rapidly expanding commercial market for the plated tubes. Further, the process is labor intensive and requires experts in electrochemistry to do the job. For example, creating alloys by mixing the stock chemicals also lacks precision and control unless experts perform the work. When the plated sidewall needs to be removed, changed, or renewe3d, the process is slow and inefficient.

What is needed is a faster, more precise method to create the plated sidewalls that can be done by personnel with modest levels of commercial skills. The plated surface needs to be easily installed into the removed from an exothermic reaction tube.

SUMMARY OF THE PROPOSED SOLUTION AND THE ADVANTAGES THE PROPOSED SOLUTION PROVIDES:

A solution to the problems with the existing technologies is to use well-known commercial metal spraying metal spraying methods called thermal spraying or plasma spraying. Commercially available equipment is available for this purpose, or companies can be hired to thermally spray components with a wide array of geometries. Catalyst bands or rings can be machined to easily fit inside the reaction tube and their interiors can be sprayed onto the inside of the proposed rings. The rings containing the desired hydrogen-absorbing metal or alloys can then be inserted into the reaction tube. This method has the advantage of speed of manufacturing and ease of installation, operation and removal.

DETAILED DESCRIPTION OF THE PROPOSED SOLUTION AND FIGURES:

The basic idea behind thermal spraying is well described in Figure 1. Plating is accomplished by feeding a pure metal or alloy feed stock into the thermal spray head. The metal is melted and propelled forward by controllable compressed airflow. The speed of the airflow, the thickness of the metal wire and its transport speed control the properties of the deposit. Varying the wire thickness and its transport speed can control the thickness and coarseness of the deposit. Recent research by the inventor suggests that the formation of vacancies in a metal deposit will produce a higher thermal density, which is desirable. Deposit coarseness lowers the vacancy formation energy so more vacancies can be formed in the deposit. The method depicted schematically in Figure 1 can control deposit coarseness and in turn influence the concentration of vacancies in the deposit.

A variation on the wire method depicted in Figure 1 can also be used. The method uses a reservoir of metal powder that can be fed into the heated area of the thermal spray head. Metal powder that can be fed into the heated area of the thermal spray head. Metal powder is then used as the feedstock and has the advantage of alloying. A mixture of powders can be used to create a deposited alloy. Metal powder is

also likely to provide more variation in deposit thickness, as the power can be obtained in varying mesh sized ranging from coarse to fine.