Decrepitation process of a hydride forming material observed by Neutron Radiography

A. Biasetti[1], J. Marín[2,3], G. Meyer[1,2], E. M Borzone[2,3], A. Baruj[1,2,3]
[1] *CONICET, Argentina*
[2] *Centro Atómico Bariloche, CNEA, 8400 Bariloche, Argentina*
[3] *Instituto Balseiro, CNEA-U.N. Cuyo, 8400 Bariloche, Argentina*

Tel.: +54 (9) 294 4445100 E-mail: andres.biasetti@cab.cnea.gov.ar

Hydride-forming materials are widely investigated for hydrogen storage, separation and purification, due to its reversible reaction with hydrogen at moderated pressures. These materials are mainly used in powder form and they show a considerable change in cell volume during the reaction with hydrogen (up to 27% for $LaNi_5$). This change can exert significant mechanical stresses upon the container vessel walls.

We have been studying this phenomenon by measuring the mechanical strains generated on the wall of a cylindrical vessel (Figure 1) during hydrogen absorption/desorption cycling. The complexity of studying the mechanical effects is due to the granulometry, porosity and flowability of the powder material are affected by the processes of decrepitation along the cycles. In this sense, neutron imaging has proven to be a useful technique to visualize the evolution of the powder rearrangement inside the reservoir. We have identified some key aspects for understanding the relationship between the degree of compactation of the powder, the geometrical parameters of the reservoir (slenderness, wall thickness, filling level), the equivalent pressure exerted by the material against the reactor walls, as well as the number of cycles.

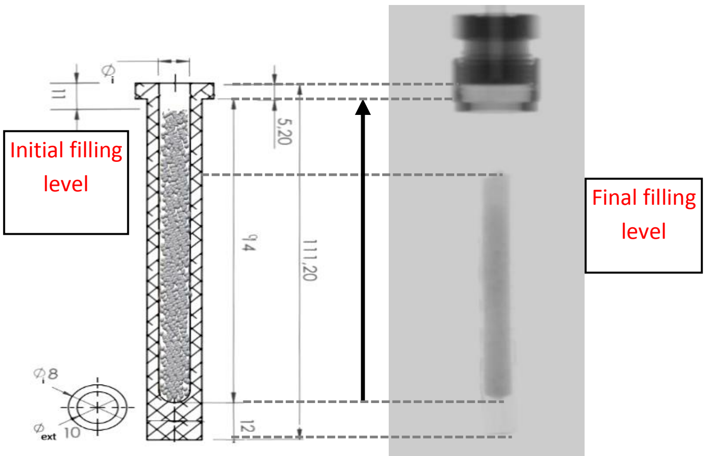

Figure 1: Powder fill level before (left) and after (right) 100 hydriding/deyhidriding cycles. The compactation process and changes in the granulometry are clearly revealed by neutron radiography, leading to the possibility of correlating this with the mechanical stress estimated.

Thermal Neutron Measurements with an Unpowered, Miniature, Solid-State Device

Will Flanagan [1, 2, *], Tim Hossain[1], Clayton Fullwood[1], Peter Hedlesky[2], John Rabaey[2], Steven Block[2], Aidan Medcalf[2], Tracy Tipping[3]

[1]Cerium Laboratories, LLC (Cerium,) 5204 E Ben White Blvd, Austin, TX 78741 - United States.
[2]University of Dallas (UD) 1845 E Northgate Dr, Irving, TX 75062 - United States.
[3] The University of Texas at Austin Nuclear Engineering Teaching Laboratory (NETL) - 1131 Creativity Trail, Austin, TX 78758 - United States
** Corresponding autor: will.flanagan@ceriumlabs.com.*

A prototype neutron detector has been created through modification to a commercial non-volatile flash memory device. Studies are being performed to modify this prototype into a purpose-built device with greater performance and functionality. This presentation will describe a demonstration of this technology using a thermal neutron beam produced by a TRIGA research reactor. In this demonstration, a beam profile is measured with a 4x4 array of 16 prototype devices.

Cultural heritage research on the neutron instrument Dingo at ANSTO

Filomena Salvemini[1], Ulf Garbe[1], Joseph Bevitt[1]

[1]*Australian Nuclear Science and Technology Organization, Lucas Heights 2234 NSW (Australia)*

Tel.: +61 (0) 4 77757201 E-mail: filomena.salvemini@ansto.gov.au

In cultural heritage research, the technological know-how developed, transmitted, then faded with the passage of time can be rediscovered by investigating the artefacts produced within a cultural contest and preserved till today. However due to the value and rarity of such material documents, it is mandatory to investigate them without affecting their integrity.

Neutron imaging, and more broadly neutron radiation techniques, are an established means for the non-invasive investigation of objects of art, museum pieces and archaeological findings. The fundamental properties of the neutron make this sub-atomic particle the ideal probe to survey the bulk of a variety of heritage materials, such as metals, pottery, organics, etc.

On the neutron instrument Dingo at ANSTO, cross-disciplinary collaborations have led to a series of successful case studies. Neutron imaging has been applied in synergy with other methods to understand how ancient artefacts were made, ranging from ancient weaponry to the first minted coins.

Neutron Imaging Services at Phoenix's Accelerator Based Imaging Facility

Benjamin Bargsten Johnson[1]

[1]Imaging Center - Phoenix, LLC, 5125 Lacy Rd, Fitchburg, WI, 53711, USA.

Tel.: +1 (608) 210 3060 E-mail: benjamin.johnson@phoenixwi.com

Phoenix, LLC's state-of-the-art radiographic imaging center is the first facility of its kind to offer commercial neutron imaging services without the use of a reactor. The imaging center's compact, high-yield, accelerator-based neutron imaging system produces collimated sources of both thermal and fast neutrons for imaging applications. Conventional film-based neutron radiography at the imaging center produces the highest measurable image quality by ASTM standards.

Located in Fitchburg, Wisconsin, USA, the 10,000 square-foot facility came online late in 2019. Since its inception, we have actively explored many new applications of fast and thermal radiography and continue to look for more opportunities in the R&D space.