

MANUFACTURING SUBCOMMITTEE

Update to HTAC

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Charter and Formation

Investigate potential opportunities for advanced manufacturing to benefit H2 and Fuel Cell production and commercialization

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Challenges

- Focus and structuring process
- Definition of “advanced manufacturing”
- Range of H2 production and Fuel Cell Technologies
- State of development / commercialization
- Finding and incorporating previous efforts

Focus and Process

- **Two pronged approach:**
 1. Sample industry to identify the range of manufacturing technologies and processes which could be considered.
 2. Analyze a subset of commercial or near commercial fuel cell and hydrogen production products / technologies to determine where there might be an opportunity to applying advanced manufacturing techniques.
- **Tools used** include literature search, questionnaires and interviews.
- **Target output** is a report on the status of use of manufacturing techniques, identification of additional opportunities for advanced manufacturing and identification of facilitation opportunities to enable further exploration and use.

Activities

- The group sought out additional members from industry.
- Participated in helping to structure discussion topics / questions for Clean Energy Manufacturing Initiative Toledo, Ohio regional summit (6/21/13).
- Conducted initial H2/FC industry survey/interviews on use of advanced manufacturing techniques (see Initial Feedback below).
- Researched existing materials on advanced manufacturing techniques and use in H2/FC industry (see Resources below).
- Generated data collection tool / questionnaire and process for H2/FC industry sampling (see Next Steps).

Initial Feedback (informal interviews, limited sample size)

Common themes:

- All have demonstrated H2 and Fuel Cell products which are commercially suitable, but address a narrow market, due to cost
- Very few commercial players trying to change the landscape, generate adoption, etc.
- Product cost and/or H2 availability/cost are the key barriers to accelerated growth
- All currently focus on batch and manual labor methods due to rate of technical change and low volumes

Take away points with regards to advanced manufacturing methods/technologies:

- A few components make a significant difference in cost and performance, e.g. stack and components for FC and compressors for H2 production.
- Higher and more consistent demand/volume of products is the most important factor to help suppliers of key components significantly reduce cost.
- Standardization across companies and applications is the second most important factor to help suppliers reduce their cost of key components.
- Supply chain fatigue and quality performance. Unwilling to project cost/volume, invest in the future due to multiple stops and starts with fuel cells.
- Performance (other than cost) in the key components does not seem to be a focus.
- There is skepticism about new manufacturing techniques being able to help commercialization in near term.
- Most final assembly is batch/hand due to it being more cost effective at current volumes than automated approaches. Methods introducing automation that can deal with a wide variety of product types/models could be useful at higher volumes.
- Specialized / new manufacturing techniques at the component supplier level could be beneficial, but requires investment in an uncertain and historically unreliable end market.
- Not my problem syndrome. Fuel cell equipment providers and hydrogen fuel providers pointing at each other as the problem for better economics and growth. Potentially unrealistic expectations of H2 fuel prices.
- The “next big thing” in technology, e.g. platinum free, is always brewing. Added investment uncertainty.

Next Steps

- Webinar for subcommittee on additive manufacturing status
- Launch broad questionnaire process and conduct follow up interviews and analysis in conjunction with NREL.
- Target companies for questionnaire:
 - **H2 Producers:** Proton, Hydrogenics, Teledyne, ITM, Siemens
 - **Fuel Cell Stack/Integrators:** Ballard, Plug, Alteryg, Relion, Fuel Cell Energy, Clear Edge, Bloom, Nuvera, SFC, Intelligent Energy, Nedstack, Panasonic, Sanyo, Toshiba, POSCO, Delphi, Accumentrics, Axane, Future E, General Motors
 - **Key suppliers:** 3M, Gore, JM, MetroMold, Dana, DuPont, WUT, Asahi glass, Asahi Kasai, Solvicore, Ultra-AMI
- Advanced manufacturing presentation to HTAC (next meeting)
- Summarize / report findings and recommendations.

Resources

- **2011 NREL/DOE HYDROGEN AND FUEL CELL MANUFACTURING R&D WORKSHOP REPORT**
- **Manufacturing Fuel Cell Manhattan Project**, Copyright 2011, ACI Technologies, Inc. All Rights Reserved, including rights of the U.S. Government under Contract No. N00014-08-D-0758
- **New Approaches to Manufacturing Innovation in DOE**, presentation by Kelly Visconti, August 2013, EERE
- **An Assessment of the Current Level of Automation in the Manufacture of Fuel Cell Systems for Combined Heat and Power Applications**, Technical Report NREL/TP-5600-52125, August 2011