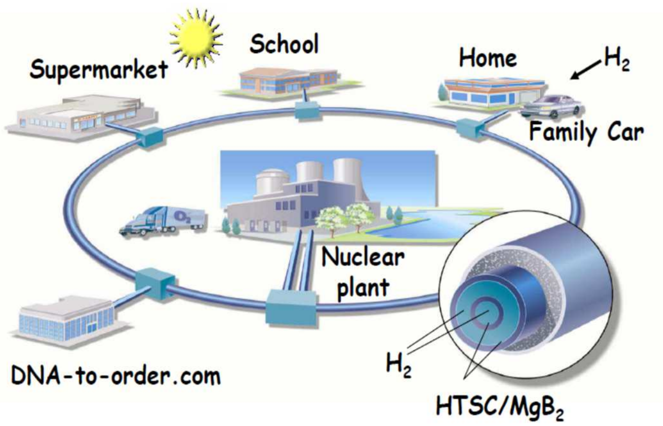
HTS superconductors and liquid hydrogen: is now the right time?

My first memory about combining liquid hydrogen and HTS superconductivity came from Paul Grant while he was at EPRI. His early 2001 Supercity sketch was very exciting particularly for me as I was starting the development of MgB2 superconducting wires, which actually do quite well at a temperature of 20 Kelvin.

I include the Supercity sketch below for those who are not familiar with it with full reference to Paul (http://w2agz.com/), and in its comprehensive version including all HTS and not only MgB2. Unfortunately for Paul and myself, the 9/11 event totally changed the approach to energy security and the idea of having an extensive network of liquid hydrogen-filled pipes and containers in combination with superconducting devices was deemed inappropriate for many years. For about a decade, I could not really remember any significant effort being made by anyone with this target in mind.



There was some activity about a decade ago thanks to Nobel Prize Prof. Carlo Rubbia, Dr. Vitaly Vysotski, and the late Dr. Michael Sander. At that time, we managed to put together a number of proposals aiming at demonstrating long distance power transmission and energy storage based on liquid hydrogen cooled MgB2 superconducting devices. In all cases, the concepts were very convincing and the economics were in favour of this solution. Unfortunately, it was still too early to allow people to accept the concept of using hydrogen simultaneously as a cooling medium and energy carrier.

Of the three initiatives, only Vitaly managed to bring some prototype to see the light (the Hydricity cable), and I am proud to be able to show a picture of a fully tested MgB2 15 kV cable prototype cooled by liquid hydrogen flow, taken in a Russian facility in Winter 2011.

Following this successful experiment, we have been working to demonstrate the endurance of MgB2 superconducting technology in a liquid hydrogen environment but, unfortunately, we were still unable to break the barrier of scepticism against this solution. As of today, ASG has no active projects or applications combining HTS and liquid hydrogen in a single device.

Recently, the wind has significantly changed in favour of the hydrogen economy, but I am not totally sure that the hydrogen community of today is fully aware of the tremendous advantage that they would gather from proposing solutions that combine liquid hydrogen and HTS materials. As a matter of fact, compressed gaseous hydrogen is largely preferred to liquid hydrogen today. I wonder if the application of HTS materials may shift the preference to a liquid hydrogen technology in many cases. Lossless energy transmission, conversion and storage all become more feasible if we join forces and combine the two technologies into one.

I am willing to write more on this topic and ask the community to do the same. We still have the time to inform about this unique chance we have been anticipating for more than two decades.

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