

AE TESTING OF COPVs SUBJECTED TO MECHANICAL IMPACTS

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Abstract: To reduce greenhouse gas emission as targeted in the European Energy Roadmap 2050, hydrogen energy is one among the main clean energies that have to be increased. Currently, the most adequate technology meeting the needs for hydrogen storage (lightweight, high lifetime at high pressure) is composite overwrapped pressure vessels (COPVs). These cylinders are exposed to damage occurring from mechanical impacts (drop of cylinder, drop of objects, etc.). External impacts can affect performance, even if the damage was barely visible. A complementary technique, to Visual Testing, is therefore necessary to assess the remaining performance after impact, and thus the residual lifespan. Periodic inspection using hydraulic proof test is not well suitable for COPVs mainly due to the level of the pressure to be applied, which is too high. It suffers also from a lack of sensitivity (i.e. no leakage does not imply that there is no damage!). Alternative inspection using acoustic emission testing technique (AE) can provide a better assessment of damage occurrence and level in COPVs. Nevertheless, there is no internationally recognized AE procedure directly applicable for COPVs. To this aim a pre-normative research program on resistance to mechanical impact of COPVs has recently been launched under the European Union's Seventh Framework Programme (FP7/2007-2013): HYPACTOR. In this work, an approach combining mechanical impact, damage characterization (with visual inspection, thermography, deflectometry, shearography, tomography, ultrasonic testing), AE testing (static and fatigue) and burst test, is investigated in order to establish AE pass/fail criteria for COPVs. The main obtained results from several experimental tests performed jointly in France and in Poland, will be exposed and debated during the conference.

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