The effect of defueling rate on the temperature evolution of on-board hydrogen tanks

Abstract:
During the driving of a fuel cell car, the expansion of the hydrogen during the defueling of the high pressure storage tank produces a cooling of the gas inside the tank. The tank can also experience a fast depressurization during acceleration or under an emergency release. This can result on the one hand side in the surpass of the low safety temperature limit of -40 °C established in the standards and regulations for on board compressed hydrogen tanks and in the other hand side in the cooling of the walls of the tank. In the present paper, the defueling of two different types of on board hydrogen tanks (Type III and Type IV) has been performed in all the range of expected defueling rates. The lowest temperatures inside the tank have been found on the bottom part of the Type IV tank in very fast defuelings. At average driving conditions, in both type of tanks, the inside gas temperature gets closer to that of the walls and the tank would arrive to the refueling station at a temperature significantly lower than the ambient temperature.

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