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Hydrogen Storage in Nanostructured Materials for Automotive Applications

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Hydrogen is a promising energy vector, with an energy content (LHV) which is about three times that of gasoline. In the next future, fossil fuels will get more and more scarce and will eventually become no more feasible in the field of transportation. In such a future scenario, electric vehicles powered by fuel cells running on hydrogen are expected to play an important role in automotive applications. In this context, finding efficient, cheap and safe on-board hydrogen storage solutions is a primary goal.

The presently most diffuse storing techniques, such as compression, liquefaction and absorption in metal hydrides, are briefly overviewed. Some of the main drawbacks of these storage solutions are the huge amount of energy required to compress or liquefy hydrogen (15% and 30% of hydrogen LHV, respectively) and the extremely low gravimetric capacity of metal hydrides (generally less than 3 wt%).

A possible way to overcome these disadvantages is offered by nanostructured materials (NSMs): thanks to their very high surface area, NSMs can contain a significant amount of adsorbed hydrogen. A theoretical understanding of the hydrogen-substrate interaction mechanism is crucial in order to engineer NSMs with *ad hoc* properties. The hydrogen storage capacity of carbon-based NSMs can be significantly improved by properly doping the carbon structure with transition metal clusters. Particular attention is devoted to Metal Organic Frameworks (MOFs) and on the dependence of their storage capacity on pores? volume.

Thanks to their potentialities and tunable properties, NSMs could provide a breakthrough solution for hydrogen storage on-board vehicles, thus catalyzing the advent of an hydrogen economy.

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