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APPLICATION OF NANOMATERIALS FOR DEVELOPMENT OF ALTERNATIVE VEHICLES

Nanomaterials have a wide range of applications in different areas, including chemistry, physics, electronics, materials science and biomedical sciences. Automotive industry also belongs to areas that expected be influenced by nanotechnologies in nearest future. Generally, nanotechnology is an opportunity to influence the properties of materials in a way that smaller but more capable and more intelligent systems. However nanomaterials are often differ from those of bulk materials what opens new area in application of well-known materials with new properties The interest to nanomaterials is growing up every year and almost \$10 billion investment (in the U.S.) is reported in the last five years.

Nanomaterials can find application not only in cars, airplanes and bicycles but there are other examples of transportation means that have had great impact with the nanotechnology evolution. S.R. Pereira and M.C. Coelho [1] have summarised the most common applications of nanomaterials in transportation sector: 1) Engine and fuel systems; 2) Resistant exterior and paints; 3) Car interior; 4) Aircraft structure and framing; 5) Batteries; 6) Coatings for defence vehicles; 7) Led lights and 8) Nanoparticles for wear resistant tires. By some estimations, the design and conception of buses, light and heavy vehicles can be affected by nanotechnology in up to 60% during next 10 years [2].

The most prospective types of future vehicles are hybrid electric vehicles and electric vehicles. However, their development is limited because of the several disadvantages (large weight of battery, for instance). Due to their small dimensions, the nanomaterials have been associated to the development of batteries in order to reduce the vehicle weight and the battery dimension, battery cost, to increase the safety and the battery storage capacity.

The use of nanomaterials in vehicle structure is another potential application of nanoproducts for reducing of the vehicle weight and as result, his consumption. Nanotechnology has provided developing lighter vehicles, thus reducing fuel consumption without compromising vehicle safety. For instance, Ning et al. [3] demonstrated that it is possible to reduction of 55% in a bus weight using thermoplastic composite body panel instead of a conventional bus with aluminum skin and supporting steel bars.

Other possible incorporation of nanomaterials for transportation applications is using of polymer exchange membrane fuel cells. The wide application requires cathodes and anodes with high electro catalytic activity in order to improve their efficiency.

The use of nanomaterials, in particular carbon nanotubes is impressive example the using of nanotechnologies for development of fuel storages (H₂ storage). Several studies have been conducted in order to store H₂ in nanomaterials. However, despite the wide variety of methods using nanotechnology for H₂ storage, there are very few

studies that evaluate the environmental and human health impacts of these storage methods.

However the fast growing of nanomaterials production is directly connected with amounts of nanoproducts which soon or later will reach the environment as nanowastes. So, the knowledge about the nanowastes and their impact on environment and human health is going to be important. In the last decade the concern about the potential impacts of nanomaterials on environment and human health has been increasing.

It is clear that nanomaterials can have a great technological impact in automotive industry, namely in the development of alternative propulsion types in vehicles (hybrid electric vehicles and electric vehicles with H₂). The applications in fuel cells, batteries, fuel storage and in vehicle structure in order to reduce the vehicle weight and consequently the fuel consumption are just simple examples of their applications. Nevertheless these nanoproducts cannot be used without having full knowledge of their potential impacts in human health and environment.

References

1. Pereira, S.R., Coelho, M.C. (2015) International Journal of Hydrogen Energy, 40 (14), pp. 4969-4979.
2. Bidmon, M., Valadon, H., Ebner, R., Loeffler, J. (2005), NanoRoad Nanomaterial Roadmap 2015, Sixth Framework Programme.
3. Ning, H., Janowski, G.M., Vaidya, U.K., Husman, G. (2007) Composite Structures, 80 (1), pp. 82-91.