

# PROPERTIES OF THE CARBON FOUND IN THE ATOMIC STATE AND NANOPARTICLES USED TO GENERATE HYDROGEN FROM WATER WITH APPLICATIONS TO THERMAL PLANTS

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*Summary:* This paper highlights several important properties of the carbon found in the atomic state and nanoparticles. They were observed during experiments made with a membrane electro-catalytic system for obtaining a hydrogen-based fuel gas from water covered by a patent (International Application No. PCT/RO2011/000015 published under No. WO 2012/011 829 on 26/01/2012). The hydrogen generator built in accordance with the international application mentioned above works under normal pressure and temperature conditions, being comprised of a high frequency source, a programmable control system, a membrane electro-catalytic module with cylindrical metal electrodes in concentric arrangement and a module for processing of the generated fuel gas. The space between electrodes comprises granular carbon in the atomic state and nanoparticles which acts as a catalyst for the water decomposition reaction, with a small proportion of other metal particles. The final module for fuel gas processing comprises a composite membrane and a Mg charge as catalyst, which ensure the reduction of the CO<sub>2</sub> at pure carbon, reusable in the mentioned electro-catalytic process. This component of the system was developed in another patent (International Application No. PCT/RO2012/000019 published under No. WO 2013/157974 on 24/10/2013), to eliminate harmful gaseous emissions by burning them together with the hydrogen in the presence of the magnesium catalyst. The properties highlighted by the development of the membrane electro-catalytic process above presented are the following:

- the carbon, in atomic state, have very high values of electrical conductivity and thermal conductivity
- the carbon, in atomic state and in combination with water, form a very good electrolyte;
- the carbon, in atomic state, is a stabilizer for hydrogen;
- the carbon, in atomic state, is an excellent catalyst.