



LASER-BASED PRODUCTION OF CARBON NANOFIBER NON-WOVEN FABRIC

Task

Carbon fiber non-woven fabrics provide an excellent starting point as membranes, as a conductive medium in energy applications, or as a deposition medium in filter applications. All three applications require high specific surfaces of the non-woven fabric for optimum material behavior. To produce the carbon nanofibers, an electrospinning process is used to form polyacrylonitrile (PAN) fibers, which are subsequently subjected to thermal treatment and stabilization in a furnace. In a final process step the carbonization of the stabilized non-woven fabric takes place.

Method

Within the framework of the AiF [the German Federation of Industrial Research Associations] project »ePolyVlies«, the last process step of the carbonization of the non-woven fabric is being investigated by means of laser-based thermal post-treatment. Due to the high heating rates achieved, 10 to 50 K/s, via the laser radiation, large amounts of process gases are released as byproducts during the carbonization process. The rapid evaporation leads to the formation of nanometer-sized pores, which induces the generation of large specific surfaces of the non-woven fabric.

Results

At the DWI – Leibniz Institute for Interactive Materials, BET measurements were carried out to determine the size of the surfaces by means of gas adsorption. The measurements show that non-woven fabric produced by the conventional furnace process has a specific surface area of 12 m²/g. The specific surface area of the laser-based carbonized non-woven fabric has a value of 490 m²/g, which is about 40 times as high as non-woven fabric carbonized in an oven-based process.

Applications

The process presented here has potential for use in membranes as well as energy and filter applications.

The R&D project underlying this report was carried out on behalf of the Federal Ministry for Economic Affairs and Energy under grant number 17973 BG/2.

Contact

Dipl.-Ing. Philipp Lott
Telephone +49 241 8906-8036
philipp.lott@ilt.fraunhofer.de

Dr. Jochen Stollenwerk
Telephone +49 241 8906-411
jochen.stollenwerk@ilt.fraunhofer.de

3 *Laser-based nanofiber non-woven fabric*
(source: DWI, Aachen).