FAST AND TUNABLE PRODUCTION OF FILTERS FROM PREFABRICATED NANOFIBERS

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HINTERGRUND

Electrospinning is the state-of-the-art technique for the preparation of nanofiber nonwovens and can produce superior porous materials. The process is simple and scalable, and can produce a broad range of different material properties. Possible applications are filtration materials, but also composites, hydrogen storage and fuel cells, tissue engineering and drug release, and plant protection. However, electrospinning has major drawbacks: it is time-consuming and difficult to produce well-defined nonwovens by directly spinning fibers onto a support. A method that simplifies this coating process and thus enables broader industrial application of electrospinning would be of high commercial relevance.

LÖSUNG

Nanofibers are commercially available from different suppliers, e.g. as fiber mats. The invention describes how stable suspensions can be formed from short-cut electro-spun nanofibers. These suspensions can then be processed to high-quality 2D and 3D nonwovens in an easily controllable manner. Examples produced by the inventors include self-reinforced polyimide nanocomposites and 3D ultra-porous and ultralight polymer sponges. Wet-laid filter materials produced using the invention have comparable aerosol filtration properties to non-wovens obtained directly by electrospinning.
Schematic drawing of nonwoven preparation by either directly spinning onto a support (top, center) or by wet-laying of short nanofibers (top, right).

VORTEILE

Advantages of the innovative wet-laid process:

- Much faster compared with direct electro-spinning onto substrate
- Cost-efficient: simple processing of pre-fabricated nanofibers
- Coating weight per area can easily be controlled
- Permits coating of complex substrate shapes
- Allows design of many new composite materials
- Existing machinery (e.g. for paper production) can be used

ANWENDUNGSBEREICHE

The innovation is relevant for important fields such as e.g.:

- Construction
- Automotive and aviation
- Agriculture and horticulture