Project Title: DEVELOPMENT OF NANO-FIBER BASED TEXTILES

Date of Commencement: 1ST JANUARY'2010

Date of Completion: 31ST DECEMBER'2011

Principal Investigator: Dr. Md. S. Rahman, Assistant Director [E Mail: safikurr@gmail.com]

Objectives of the project:

To produce Nano-fiber textiles using Electrospinning technique and product development with highly efficient barrier properties.

The Electrospinning machine from ELMARCO, Czech Republic was installed in the month of August-September 2011 at ATIRA.

Methodology of Working :

- Production of Nanofiber based nanoweb of selected polymer on selected substrate by electrospinning technique on a continuous production machine for consistent product quality.

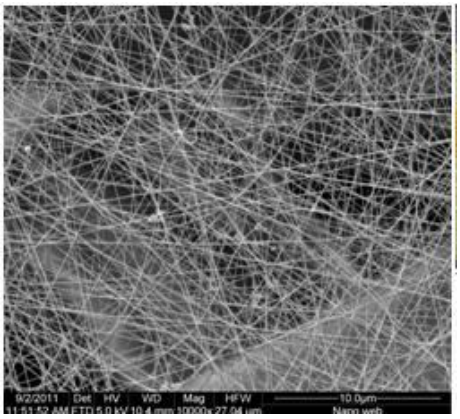
- Product Development [efficient nanofiber based filtration medium], involving the industry.
  - Face Mask
  - Heavy duty filtration Device [Automotive engine filter]

PROTOTYPE DEVELOPMENT

While developing the products, industries got involved and the prototypes have been developed in close cooperation with the industries. Prototypes of following product have been developed:

- **Face Mask**

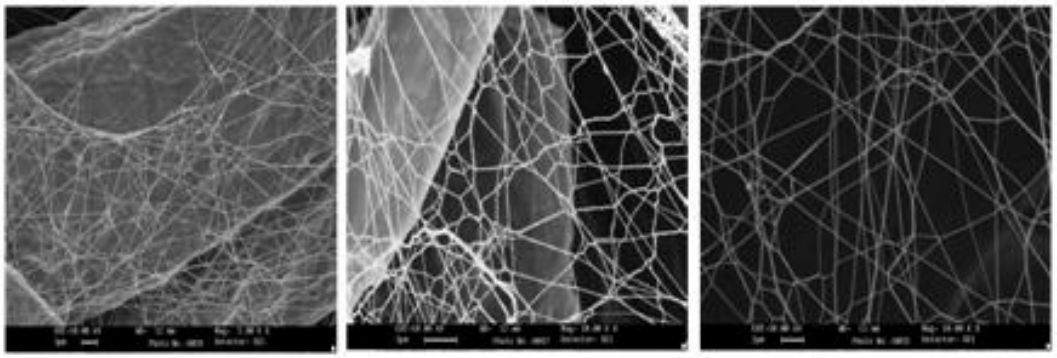
FACE MASK



SEM of PA 6 Nanoweb [Average fibre diameter: 80 nm]

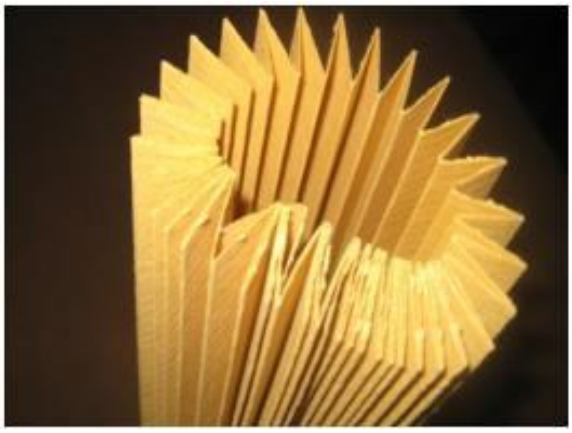
Using the composite nonwoven as filer media, light weight disposable face masks have been developed. Such media has filter efficiency of ~99% when evaluated as per EN-143 On TSI Automated Filter Tester Models 8127.

➢ Automotive Engine air Filter



SEM of Nanoweb on Paper substrate used in Automotive Filter Media

Automotive Engine Air Filter Module



Nanoweb on Paper Filer Media

Detailed analysis of results indicating contributions made towards increasing the state of knowledge in the subject:

In both the developmental work described above, ATIRA could develop Nanowebs i.e. a kind of Nonwoven layer of Nanofiber of average fiber diameter ~ 80 nm supported on two different varieties of substrates namely Spunbond PP nonwoven and Paper with optimal performance suitable for specific end uses.

The pore diameters measured i.e. in the range of ~400 nm, also indicates the capability of the filter media for finer degree of filtration.

Through this project work ATIRA acquired and demonstrated the capability of development of latest Filter media known in the world and development of two prototypes in collaboration with industry.

Conclusions summarising the achievements and indication for future work:

Nanofiber -nanoweb and use of the same for making filter media of finer and finer degree of filtration is a new and emerging area of R & D globally. ATIRA started the developmental effort straight way using the Pilot plant Electrospinning unit. The objective was to produce the Nanoweb of a reasonable width with consistent quality so that the filtration media developed can be of repeatably made with reproducible quality.

Two prototype products have been made with two different types of Nanoweb filter media i.e. using spunbond PP Nonwoven as the substrate, for Face Mask and resin treated paper as substrate for making filter media for automotive engine air filter system.

ATIRA started getting queries from varieties of industries for applications like water filtration/treatment, high performance surgical gowns, Protective Textiles, CNT filled epoxy nanoweb for high efficiency filter media for high temperature corrosive environment etc. With continuous production pilot plant facility for the Nanoweb production with variation of substrate and the polymer in place and trained manpower to work on it, ATIRA is now capable to develop high performance Nanofiber based filtration products in near future.

Papers in Conferences:

- "Nano Textiles" by Md. S. Rahman and Aridam Sarkar of ATIRA, presented at 51st Joint Technological Conference of ATIRA, BTRA, NITRA and SITRS, held at NITRA on 10th April 2010

- "Development of nanoweb based high efficiency composite nonwoven for finer degree of filtration": Md. S. Rahman and A. K. Sharma; Middle East & North Africa Nanwovens Symposium and Exhibition ,EDANA, 14-15 February 2012, Dubai

- "Nano Textiles" by Md. S. Rahman, D.M. Chaudhary, Nitin Charhate and R. V. Chikkani to be presented at 53rd Joint Technological Conference of ATIRA, BTRA, NITRA and SITRA, to be held at Mumbai on 17th and 18th February, 2012;

Patent:

Nanofiber membrane layered filter media - Indian patent filed

(C.B.R No. 442, Dt 11th January 2012)