RUBBER NANOFIBROUS MEMBRANES BY ELECTROSPINNING AND PHOTO-CROSSLINKING

Parnian Kianfar, Sara Dalle Vacche, Roberta Bongiovanni, and Alessandra Vitale

Department of Applied Science and Technology, Politecnico di Torino,
10129 Torino, Italy

Electrospinning is a unique technique to produce fine submicrometric fibers from polymer solution or melt. In particular, the fabrication of rubber nanofibrous membranes by electrospinning has recently attracted significant attention owing to their interesting properties (e.g., superior elasticity, high extensibility, elastic recovery and resilience), and their potential applications in stretchable electronics, (bio)filtration and sensing [1]. However, electrospinning of rubbers and the production of rubber fibrous membranes with a stable morphology can be difficult and complicated, due to their high viscoelasticity and low T_g.

Herein, butadiene-based nanofiber membranes are obtained by different electrospinning processes (i.e., solution electrospinning, electrospinning of latexes and electrospinning of liquid polybutadienes). A photoinduced thiol-ene crosslinking reaction is then applied (Figure 1a) to increase the stability of the membrane, as well as to enhance and tune its physico-chemical, thermal and mechanical properties [2]. It is demonstrated that high-performance morphologically stable, insoluble, mechanically durable, flexible and stretchable nonwoven nanofibrous materials are obtained (Figure 1b and c).

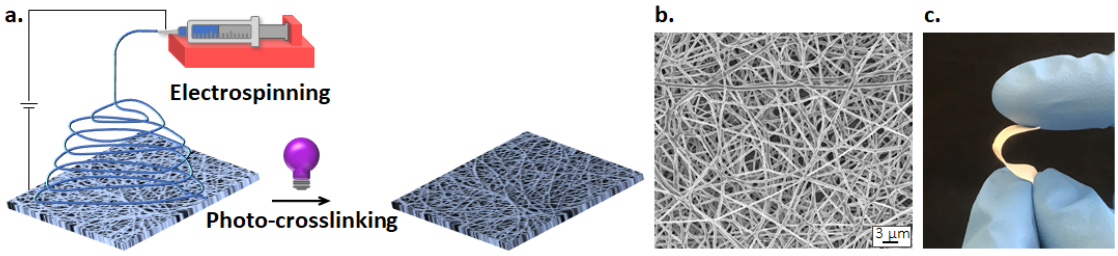

Figure 1. a: Scheme of the process, which couples a first electrospinning step and a subsequent photo-crosslinking reaction. b: FESEM image of a rubber photo-cured electrospun mat. c: Picture of a photo-crosslinked fibrous membrane showing its flexibility.

[1] J. Yoon, J. Lee, J. Hur, *Nanomaterials* 8, 541 (**2018**); H.-C. Hsieh, J.-Y. Chen, W.-Y. Lee, D. Bera, W.-C. Chen, *Macromol. Rapid Commun.* 39, 1700616 (**2018**).

[2] A. Vitale, G. Massaglia, A. Chiodoni, R. Bongiovanni, C. F. Pirri, M. Quaglio, *ACS Appl. Mater. Interfaces* 11, 24544–24551 (**2019**).