Electrospun PMMA Fibers Demonstrate Migration of Nanoscale Self-Stratifying Additives

Researchers at the Army Research Laboratory (ARL) at the Aberdeen Proving Ground, MD, in conjunction with scientists at the Virginia Polytechnic Institute and State University (VT) at Blacksburg, VA, have employed polymeric additives developed at ARL in the preparation of nano-scale fiber mats using the technique of electro-spinning. Previous ARL research reported the development of hyperbranched polymer additives which spontaneously concentrate at the air interface of a solvent-cast coating during cure. The current report is significant in that it demonstrates the effectiveness of the additives in a fiber-spinning process and shows that the migration can occur at the very short time scales associated with the electrospinning process.

Electrospinning is a technique for preparing micro- and nano-scale fibers from a polymer solution subjected to a high voltage. The polymer solution is splintered into multiple filaments to alleviate electrostatic repulsion, resulting in a non-woven fiber mat. These filaments lead to fine fiber dimensions (Figure 1) and rapid drying times, and the resulting fiber mats are of interest for a variety of air filtration and military textile applications. The migration of the HBP-based additive in the fibers was confirmed using multiple surface analytical techniques.

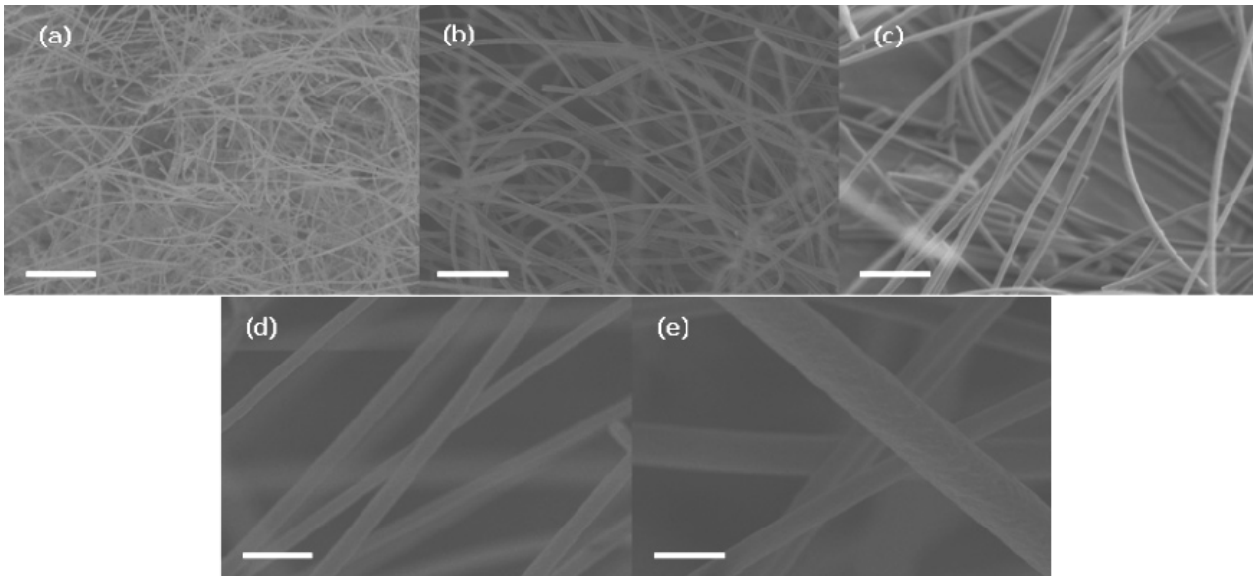

Figure 1 shows electrospun PMMA fiber mat incorporating 1% HBP-based additive. The fibers were prepared from solutions of different concentrations, and the additive did not prevent the formation of uniform fibers. The scale bar is 10 μm.

The performance of the ARL-derived additives in an electrospun fiber mat is promising, as it demonstrates effective surface migration over very short time-scales. It hints that the self assembly of these nano-scale additives may result in a method for *in situ* surface functionalization during fiber spinning, thereby increasing efficiency and reducing potential manufacturing costs.

References/Publication

Hunley, M.T.[†]; Harber, A.[†]; Orlicki, J.A.[*]; Rawlett, A.M.[*]; Long, T.E.[‡] "Effect of Hyperbranched Surface-Migrating Additives on the Electrospinning Behavior of Poly(methyl methacrylate)," *Langmuir*, **2008**, *24*, 654-657.

[†] Virginia Polytechnic Institute and State University, Blacksburg, VA

[*] Army Research Laboratory, Aberdeen Proving Ground, MD