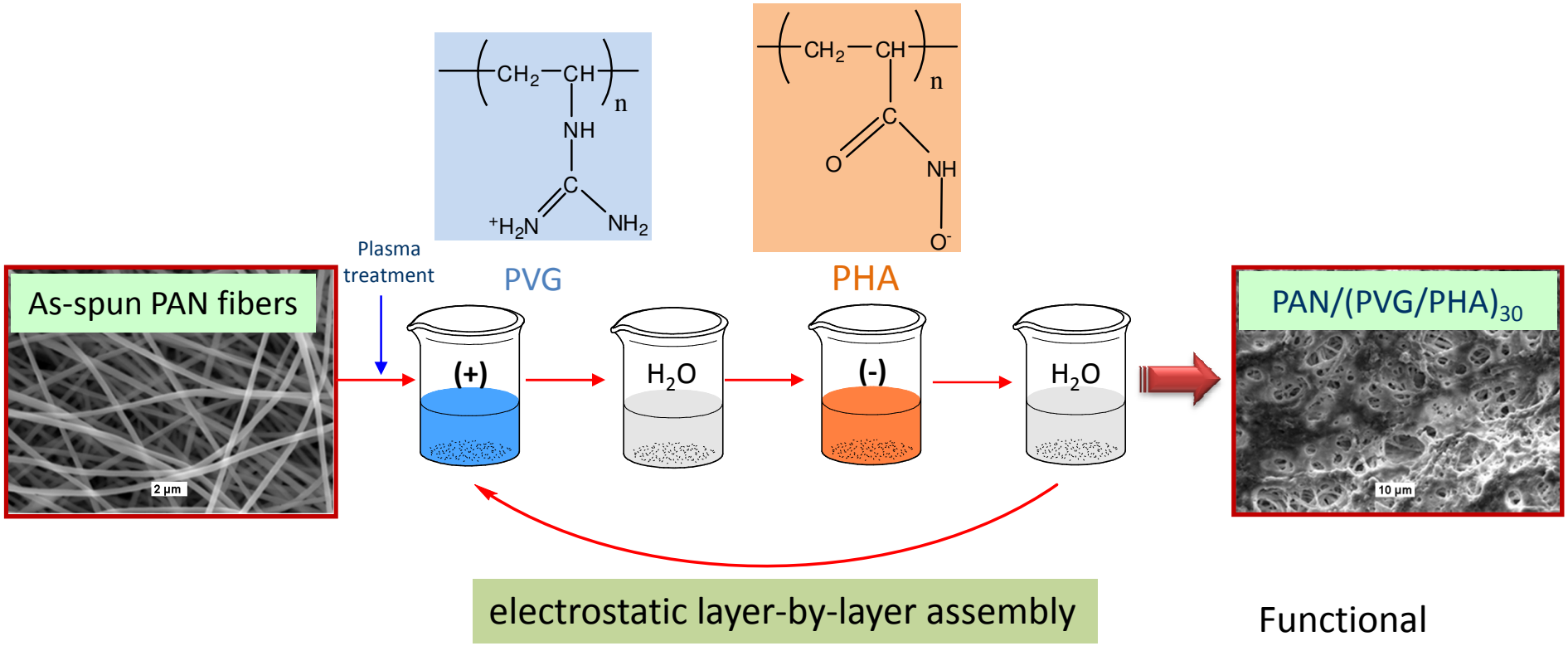
As-spun PAN fibers
2 µm
Plasma treatment
PVG
PHA
(+)
H_2O
(-)
H_2O
PAN/(PVG/PHA)$_{30}$
10 µm
electrostatic layer-by-layer assembly

Functional

Breathable, chemical and biological detoxifying protective fabrics are obtained via functionalization of electrospun fiber mats using a layer-by-layer electrostatic assembly technique. Chemically reactive polyanion, poly(*N*-hydroxyacrylamide) or poly(hydroxamic acid) (PHA), and bactericidal polycation, poly (*N*-vinylguanidine) (PVG), were synthesized and electrostatically assembled to generate multifunctional coatings on prefabricated polyacrylonitrile (PAN) fiber mats. Reactivity of PHA in the hydrolysis of diisopropyl fluorophosphate (DFP), a close analog of the chemical warfare agent sarin, was demonstrated. The DFP degradation rate with PHA is comparable to that with compounds such as isonicotinhydroxamic acid methiodide, an efficient catalyst of organophosphate ester hydrolysis. Protective fabrics functionalized with PVG/PHA layers are able to degrade DFP mists, with DFP hydrolysis rates 60-fold higher than those with unmodified fabrics under identical conditions. Fabrics modified with PVG/PHA layers are bactericidal against *E. coli* and *S. epidermidis*. Breathability and barrier performance of functionalized fiber mats as protective fabrics were evaluated versus standard reference fabrics (*Chem. Mater.* 2010, 22(4), 1429-1436).