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Reactive Fabrics for Chemical Warfare Agent Decomposition Using Particle Crystallization

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Abstract : Recently, research for reactive fabrics which have the characteristics of CWA (Chemical Warfare Agent) decomposition is being performed actively. The performance level of decomposition for CWA decomposition in various environmental condition is one of the critical factors in applicability as protective materials for NBC (Nuclear, Biological, and Chemical) protective clothing. In this study, results of performance test for CWA decomposition by reactive fabric made of electrospinning web and reactive particle are presented. Currently, the MOF (metal organic framework) type of UiO-66-NH_2 is frequently being studied as material for decomposing CWA especially blister agent HD [Bis(2-chloroethyl) sulfide]. When we test decomposition rate with electrospinning web made of PVB (Polyvinyl Butiral) polymer and UiO-66-NH_2 particle, we can get very high protective performance than the case other particles are applied. Furthermore, if the repellant surface fabric is added on reactive material as the component of protective fabric, the performance of layer by layered reactive fabric could be approached to the level of current NBC protective fabric for HD decomposition rate. Reactive fabric we used in this study is manufactured by electrospinning process of polymer which contains the reactive particle of UiO-66-NH_2, and we performed crystalizing process once again on that polymer fiber web in solvent systems as a second step for manufacturing reactive fabric. Three kinds of polymer materials are used in this process, but PVB was most suitable as an electrospinning fiber polymer considering the shape of product. The density of particle on fiber web and HD decomposition rate is enhanced by secondary crystallization compared with the results which are not processed. The amount of HD penetration by 24hr AVLAG (Aerosol Vapor Liquid Assessment Group) swatch test through the reactive fabrics with secondary crystallization and without crystallization is 24 and 146μg/cm^2 respectively. Even though all of the reactive fiber webs for this test are combined with repellant surface layer at outer side of swatch, the effects of secondary crystallization of particle for the reactive fiber web are remarkable.

Keywords : CWA, Chemical Warfare Agent, gas decomposition, particle growth, protective clothing, reactive fabric, swatch test
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