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PREPERATION OF POLY(ACRYLONITRILE-CO-METHYLMETHACRYLATE) NANOPARTICLES AND THEIR HEAT RELEASE PROPERTIES

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Hydrolysis of crosslinked poly(acrylonitrile) with an alkali solution converts the nitrile groups to hydrophilic carboxyl groups while maintaining the particle shape because of the crosslinking. The hydrolyzed, crosslinked PAN particles can be used as moisture absorption-heat release materials for fibers and fabrics. However, it is very difficult to obtain homo-PAN particles of uniform and small sizes, such as less than 300 nm, because of the strongly polarized nitrile groups. In this study, methyl methacrylate (MMA), which polymerizes to uniform and small particles easily, was used as a comonomer to produce P(AN-co-MMA) copolymer nanoparticles. Successive crosslinking with hydrazine and alkaline hydrolysis of the particles gave highly hydrophilic and non-water soluble products [hc-P(AN-co-MMA)]. The effects of copolymerization conditions on the particle size and size distribution were investigated using SEM and Zeta Size Analyzer. Increasing the MMA content in the copolymer up to 30 mol% resulted in more uniform and smaller particles that hydrolyzed more easily by alkaline solution. Both the nitrile groups and methacrylate ester groups were hydrolyzed to carboxyl groups. Nanoparticles of sizes of less than 40 nm with very narrow size distribution were obtained for an MMA content of 20 mol%. The MMA content and hydrolysis conditions affected the moisture regain and heat release properties of hc-P(AN-co-MMA) particles. The hc-P(AN-co-MMA) particles exhibited very high moisture regain of up to 48%. When hc-P(AN-co-MMA) particles with a moisture regain of 48% were added to water of twice their weight, the temperature increase was measured up to 12.9?C. When cotton fabric was treated with a 5% aqueous solution of hc-P(AN-co-MMA) particles, the temperature increase of the treated fabric by moisture absorption was 7.8?C.