

Temperature-Responsive Shape Memory Polymer Filament Integrated Smart Polyester Knitted Fabric Featuring Memory Behavior

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Abstract : Recent developments in smart materials motivate researchers to create novel textile products for innovative and functional applications, which have several potential uses beyond the conventional. This study investigates the memory behavior of shape memory filaments integrated into a knitted textile structure. The research advances the knowledge of how these intelligent materials respond within textile structures. This integration may also open new avenues for developing smart fabrics with unique sensing and actuation capabilities. A shape memory filament and polyester yarn were knitted to produce a shape memory knitted fabric (SMF). Thermo-mechanical tensile test was carried out to quantify the memory behavior of SMF under different conditions. The experimental findings demonstrate excellent shape recovery (100%) and shape fixity up to 88% at different strains (20% and 60%) and temperatures (30 °C and 50 °C). Experimental results reveal that memory filament behaves differently in a fabric structure than in its pristine condition at various temperatures and strains. The cycle test of SMF under different thermo-mechanical conditions indicated complete shape recovery with an increase in shape fixity. So, the utterly recoverable textile structure was achieved after a few initial cycles. These intelligent textiles are beneficial for the development of novel, innovative, and functional fabrics like elegant curtains, pressure garments, compression stockings, etc. In addition to fashion and medical uses, this unique feature may also be leveraged to build textile-based sensors and actuators.

Keywords : knitting, memory filament, shape memory, smart textiles, thermo-mechanical cycle

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