

## Eco-Design of Multifunctional System Based on a Shape Memory Polymer and ZnO Nanoparticles for Sportswear

**Authors :** Inês Boticas, Diana P. Ferreira, Ana Eusébio, Carlos Silva, Pedro Magalhães, Ricardo Silva, Raul Fangueiro

**Abstract :** Since the beginning of the 20<sup>th</sup> century, sportswear has a major contribution to the impact of fashion on our lives. Nowadays, the embracing of sportswear fashion/looks is undoubtedly noticeable, as the modern consumer searches for high comfort and linear aesthetics for its clothes. This compromise lead to the arise of the athleisure trend. Athleisure surges as a new style area that combines both wearability and fashion sense, differentiated from the archetypal sportswear, usually associated to "gym clothes". Additionally, the possibility to functionalize and implement new technologies have shifted and progressively empowers the connection between the concepts of physical activities practice and well-being, allowing clothing to be more interactive and responsive with its surroundings. In this study, a design inspired in retro and urban lifestyle was envisioned, engineering textile structures that can respond to external stimuli. These structures are enhanced to be responsive to heat, water vapor and humidity, integrating shape memory polymers (SMP) to improve the breathability and heat-responsive behavior of the textiles and zinc oxide nanoparticles (ZnO NPs) to heighten the surface hydrophobic properties. The best results for hydrophobic exhibited superhydrophobic behavior with water contact angle (WAC) of more than 150 degrees. For the breathability and heat-response properties, SMP-coated samples showed an increase in water vapour permeability values of about 50% when compared with non SMP-coated samples. These innovative technological approaches were endorsed to design innovative clothing, in line with circular economy and eco-design principles, by assigning a substantial degree of mutability and versatility to the clothing. The development of a coat and shirt, in which different parts can be purchased separately to create multiple products, aims to combine the technicality of both the fabrics used and the making of the garments. This concept translates itself into a real constructive mechanism through the symbiosis of high-tech functionalities and the timeless design that follows the athleisure aesthetics.

**Keywords :** breathability, sportswear and casual clothing, sustainable design, superhydrophobicity

**Conference Title :** ICSSRC 2019 : International Conference on Sustainable Style and Recycled Clothing

**Conference Location :** London, United Kingdom

**Conference Dates :** November 18-19, 2019