Seminar-I

Influence of textile substrates on the thermochromic response of leucodye based functional patches

Abstract:

Smart textiles are becoming increasingly significant in day-to-day human life. They have established their importance across multiple sectors like health, safety, comfort, and connectivity by combining traditional textile materials with sensing, actuation, and communication capabilities. Temperature responsive textiles represent one of the most promising Smart textiles. This research work investigates the effect of textile substrates and their properties on the thermochromic performance of a temperature responsive material known as thermochromic leuocodye, applied using simple Doctor Blade method. This work compares the thermochromic performance of four structurally and chemically distinct substrates- cotton, polyester, nylon, and polypropylene. The selected substrates span almost the entire spectrum of fiber chemistry, surface energy, and fabric structure, from the hydrophilic cellulosic structure of cotton to the chemically inert, low surface energy non-woven structure of polypropylene. The thermochromic performance of the thermochromic patches was evaluated for quick response time, increased retention time, colour fastness to various environments, and coating morphology. CIE (International Commission on Illumination) L*a*b* coordinates were used for measuring all the colour changes. Among the four substrates that were considered, cotton exhibited a balanced combination of highest colour difference (dE=30), longest colour retention time, acceptable response time and desirable resistance to perspiration damage. The thermal and thermochromic properties of the cotton substrate were enhanced by impregnating thermally conducting materials (TCM) such as Silver/Silver-copper/Carbon/Nickel paste. The thermal conductivity of the thermochromic patch increased from 0.0882W/mK to 0.4247W/mK which gave over 400% improvement. The results indicate that the thermochromic response time had a noticeable reduction (from ~7min to ~3min) after coating TCM. The improved results of textile properties like hydrophobicity additionally supports the potential of the developed thermochromic patch as a suitable candidate for textile-based technique for surface temperature mapping.