Adaptive camouflage for soldier's clothing

Aušra Abraitienė, Vitalija Rubežienė, Audronė Sankauskaitė, Sandra Varnaitė-Žuravliova
vitalija.rubeziene@ftmc.lt

The key targets of the Long-Term program of scientific research and experimental development of the Center for Physical Sciences and Technology „Smart and functional technologies for textile and clothing" include the development of textiles for defence purposes. Based on previous experience in military camouflage research and recent investigations in the functional textile field FTMC Textile technology department participated as a partner in the international project „Adaptive Camouflage for the Soldier II (ACAMSII)".

The development of sensing abilities, such as hyperspectral sensors and small man portable infrared sensors, battlefield radar and faster artificial intelligence based data processing call for new capabilities of camouflage materials and systems. In order to reduce the risk of EU soldiers being detected, identified and engaged in a dynamic multi-sensor environment, development of adaptive camouflage could be right solution.

The research was focused on improvement of Camouflage for the Soldier aiming to provide increased survivability for soldiers in diversified environments. The developed technology comprised actively controlled light emitting diodes and thermochromic materials for visible signature adaptation, phase change materials and biologically degradable insulating cellulose cells (cork) for thermal camouflage and radar absorbing coatings with conjugated polymer compositions.

Two research lines were pursued, resulting in two prototypes architectures, one based on LEDs technology and the other on thermochromics pigments as adaptive camouflage mechanisms. Both prototypes include microwave absorbing materials to reduce the radar signature. In the radar threat evaluation, it was pointed up that a major threat to dismounted soldiers are battlefield radars commonly operating within X and Ku-bands (8–12 GHz and 12–18 GHz, respectively). Consequently, the investigation of reflection and transmission properties of developed textile fabrics was performed in a frequency range of 6–18 GHz, which covers the defined frequencies relevant to the application. Whereas radar cross section (RSC) should always be low, the adaptation in radar range is not needed.

Prior to the public demonstration, laboratory tests of the materials and components had been performed. Ergonomic tests, signature measurements in different backgrounds and light conditions and radar cross section measurements at an outdoor test range were carried out as well (Figure 1.). The tests under relevant conditions were performed. The ability of the developed camouflage to reduce the visual, thermal and radar signatures of a soldier under certain conditions was validated. This was successfully demonstrated during field tests. It was determined that more investigation to achieve a satisfactory signature, especially in dark conditions and in SWIR is needed. Design, usability and compatibility with other equipment also have to be improved. Methods to assess adaptive camouflage have been studied, but need further development. This research has built knowledge for establishing a network of research institutes and industries that can be beneficial for future development of military textiles.

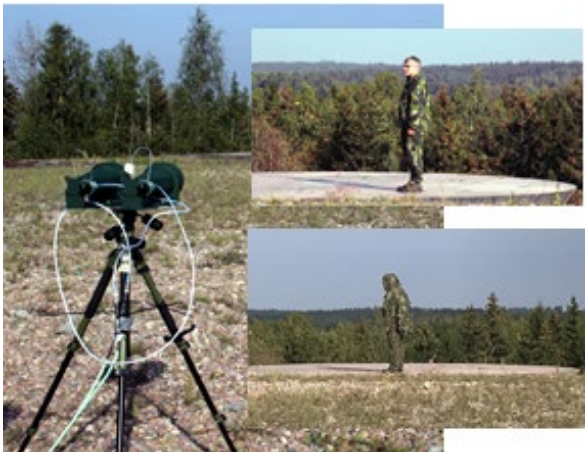

Fig. 1. Photos from radar cross section test at FOI's test site, Sweden.