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Smart and Safe Chemical Protective Clothing

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The approach of 4th industrial revolution accelerates the efficiency growth of fashion value chains due to the integration of data analysis, robotics, sensors 3D scanning and printing, internet of things, virtual and augmented reality. Intensive digitization of the majority of design and manufacturing processes leads to mass customization, which still is not widely available option for companies producing specialized clothing, e.g. personal protective garments. Advances of digital technologies enables companies to compete by increasing the quality of the products and services, on the one hand, and by reducing the costs of labor time and material consumption on the other hand. The widespread use of CAD systems in garment industry to design patterns along with database resulting from 3D scanning technology of the human body, are prerequisites for virtual modelling of the dimensional correspondence between 2D patterns and concrete human body.

Due to the huge number of variables involved, numerous levels and types of chemical protective clothing systems has been technologically developed. It must be noted that such clothing is worn on fully dressed human body and often equipped with specialized gear, what makes comfort fitting of them more complicated. The object of the investigation was chemical protective clothing (CPC) for firefighters Trellechem®VPS of encapsulating design (type VP1). Technical characteristics of the selected type of CPC show that it is resistant to a wide range of chemicals for more than 8 hours. It is also resistant to abrasion and flame due to materials and seams multilayer structure. Trellechem®VPS CPC suit follows the requirements of standards: EN 943-2/ET; EN 943-1; EN 1073-2; EN 14126.

Thus, the aim of this research was to develop the digitized method of chemical protective clothing (CPC) prototype generation, which would comprise 3D scanning with hand-held scanner technology together with virtual fitting, 2D pattern creation and material consumption calculation software by providing maximal comfort of developed clothing. Scanned data was processed with Artec Studio 11, which is industry-acclaimed software for advanced 3D scanning and data processing. It is also important that scanning of workers with different types of equipment allows to customize clothing taking into account not only workers body shape and measurements, but the size of worn equipment. Even more that the gear, which is worn for different jobs differs in size and shape.

Additional task was to integrate smart internal and external communication systems into CPC for more efficient and safe work of firefighters' and rescue team members during different type of accidents. For this reason, a close-fitting holsters, that integrate radio transmitters, headsets, remote speaker microphones and other devices were developed. Such vests are universal. i.e. could be worn under the CPC, which covers the whole body of firefighter together with gear (breathing apparatus, breathing mask and helmet). Also, they are adjustable for lighter types of clothing, e.g. when gear is worn on the top of protective clothing. Sewing and embroidering technologies were be applied to incorporate electronic components into garment.

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