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Knitted, active laser protection gloves

Objective

Working with (handheld) laser systems in the spectral range presents significant potential hazards to the operator. In particular, there is a risk of serious burns to the hands. There are no suitable protective gloves on the market that are comfortable to wear. The objective was to develop a user friendly, knitted, single layer, active laser safety glove suitable for industrial and medical use on laser systems operating in the near infrared spectral range. In order to motivate people to wear the protective clothing, it was necessary to include comfort and haptics in the development, in addition to the basic functionality.

Approach and results

The solution for the production of such a laser protection glove was the development of an elastic but dense knitted fabric. On the one hand, the use of suitable conductive, optically resistant yarn combinations was to minimise skin damage caused by laser radiation. On the other hand, the system was to be actively monitored for damage using integrated sensors, and the system was to be switched off in the event of laser exposure.

Based on the test results of the knitting samples, a prototype was developed. Additionally, the test set-up for determining the protective properties was adapted to provide small and medium-sized enterprises in the protective textile and hand protection industry with guidance for the development and sale of products against such risks. In addition to testing the physical protective properties of the material, tests were also carried out on the burning behaviour, which showed neither continued burning behaviour nor pronounced flame propagation. To determine the laser protection properties, real irradiations were carried out with determination of the change in the electrical properties of the conductive yarn and calorimetric heat flow measurements.

Gloves made from 100 % MAC/CO yarn (left) and from MAC/CO yarn + covering yarn made from Shieldex® yarn + MAC/CO yarn (right)

The material combinations of conductive material and modacrylic cotton fibres identified at the end showed a very adaptable material composition with which protective gloves with high ductility could be knitted. The conductive component proved to be applicable. It was possible to determine signal acquisition and the associated change in measured values within the real radiation tests. With the appropriate hardware, it is therefore possible to integrate such protection systems into laser systems.

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