RISKS ASSESSMENT OF SKIN BURNS RESULTING FROM A THERMAL RADIATION EXPOSURE

A FRENCH-GERMAN COOPERATION

J.-J. Serra[1], K. Simon[2]

[1]*DGA/DET/CEP LOT/EHF*
10 rue des fours solaires, Odeillo B.P. 59, 66121 Font-Romeu, France
[2]*Armed Forces Scientific Institute for Protection Technologies – NBC Protection*
Humboldtstrasse, 29633 Munster, Germany

ABSTRACT

Thermal radiation of high intensity, e.g. caused by the fireball of a weapon, is a severe danger for soldiers on the battlefield. Skin burns may be caused by direct exposure to the radiation or by conduction through the clothing. In the first case, burns of unprotected parts of the body (face and hands) are particularly penalizing and can quickly disable the soldier. In the second case, the thermal radiation absorbed by the clothing leads to a strong temperature increase of the textile layers. The skin burns then are related to the heat transferred from the hot material to the skin i.e. a function depending on the maximum temperature of the inner face of the clothing and the thermal contact between the clothing and the skin. In the worse case, the clothing may catch fire creating a secondary heat source, self-extinguishing or not.

France and Germany are preparing a common research program about skin burns under military clothing, caused by thermal radiation of high intensity. This Technical Arrangement will cover basic research work on the different aspects of the risk assessment, such as:

- Investigation on burn criteria (from temperature evolution, fluence, thermal dose,…) and their validity interval in terms of pulse duration, flux level,…
- Measurement techniques: temperature sensors (thermocouples, pyrometers), flux sensors (flux gauges) or skin simulants (commercially available or own development)
- Analysis of protection offered by textile layers (military clothing) or optical glasses (gasmask windows) as a function of their optical and thermophysical properties.

Test series will be conducted on CEP solar furnace, WIS lab and free field facilities. For the investigation, different pulse shapes, pulse durations and flux levels will be used, as well as textile samples nature and dimensions. Experimental results will be compared to numerical modeling outputs taking into account multi-layered textile material structure, semi-transparency of textile layers and clothing degradation (ignition, smoke, etc...).

The objective is to define a common procedure (common sensor, criteria, test conditions, etc...) to test military clothing and to improve protection against skin burns.

Details of this research cooperation about skin burns will be presented in the paper.