NASA TECH BRIEF

Lewis Research Center

Lightweight Protective Clothing for the Safe Handling of High-Intensity Pressurized Lamps

Lightweight, pliable, protective clothing material and lightweight face shields have been developed which effectively protect personnel handling high-intensity pressurized lamps against the hazards of accidental lamp explosions. These materials are much lighter in weight and much less cumbersome than conventional protective garments, thus facilitating lamp handling as well as providing effective protection.

Commercial high-intensity pressurized lamps are widely used in motion picture projectors, solar simulators, etc. Typically, such lamps range in size from 50 watts to 6500 watts, and 20 kilowatts, and have internal gas pressures, when cold, ranging from 1 to 20 times atmospheric pressure. Safe practice dictates that lamps be handled only when they are cold and only by trained personnel wearing effective protective clothing. Accidental damage, rough handling or overstressing can cause the lamps to explode violently with sharp quartz shards flying outward at speeds up to 161 KM/hr (100 miles/hr). Protective clothing, face shields and gloves must effectively guard against the impact and cutting action of this high velocity shrapnel. Conventional protective clothing such as flak suits, lead aprons, etc., can provide protection but is usually heavy, cumbersome, and often uncomfortable. The lightweight, pliable clothing developed provides effective protection with much greater mobility, visibility and comfort.

Five commercially available clothing materials, selected for their high cutting resistance, high strength, light weight and pliability, were tested by exposing them to exploding lamps located less than 60 cm (2 ft away). The materials included: 5018 ballistic nylon fabric, 5024 ballistic nylon fabric, a monofilament nylon mesh, a ballistic nylon felt, and chrome leather. The most effective material was a three-layer combination of 5024 nylon fabric/nylon felt/5024 nylon fabric, weighing 737 gm/m^2 (21.75 oz/sq yd). This combination of materials was impenetrable by quartz shards from exploding lamps in sizes from 500 to 6500 watts.

Some penetrations through this material were observed with 20 KW lamps, indicating that this three-layer combination was inadequate for use with the large lamps. Tests were not made to determine what additional protection would be needed.

The face shield material tested initially was a commercial high-strength polycarbonate plastic (Lexan*) 0.159 cm (0.0625 in) thick. This material was impenetrable by quartz shards from exploding lamps of all sizes up to 20 KW lamps pressurized (cold) at 7 atmospheres.

The tests of protective clothing for the safe handling of pressurized lamps have been summarized in a NASA report and a motion picture film has been prepared to supplement this report.

Notes:

1. Further information is available in the following report:
   NASA TM-X-3147 (N75-14468), Tests of Protective Clothing for the Safe Handling of Pressurized Lamps
   Copies may be obtained at cost from:
   Aerospace Research Applications Center
   Indiana University
   400 East Seventh Street
   Bloomington, Indiana 47401
   Telephone: 812-337-7833
   Reference: B75-10007
2. A film supplement entitled "Protective Clothing for Handling Xenon Lamps" (C-279, 10 minutes, color, sound) is available from:
   Chief, Management Services Division
   Mail Stop 5-5
   NASA Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135

* Trade name

(continued overleaf)

3. Specific technical questions may be directed to:
Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B75-10007

Patent Status:
NASA has decided not to apply for a patent.

Source: John G. Ewashinka
Lewis Research Center
(LEW-12073)