



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Protective Equipment

Tensile Properties of Dyneema SK76 Single Fibers at Multiple Loading Rates Using a Direct Gripping Method

UHMWPE fibers such as Dyneema and Spectra are increasingly used in lightweight armor applications because they have higher tensile strength and lower density than aramid fibers, such as Kevlar and Twaron. UHMWPE fibers are difficult to grip using typical adhesive methods because of their low surface energy, and the ability to grip UHMWPE fibers is limited to small diameter fibers that are difficult to identify and extract from a yarn. Researchers at USARL, sponsored by AMC and RDECOM, used a direct gripping method to study multiple gauge lengths of Dyneema SK76 at three different strain rates (low, intermediate, and high strain) to better understand the effect of defect distribution along a fiber on its tensile response. The tensile strength of the Dyneema SK76 fiber increased as strain rate increased from low to intermediate, but did not increase further at the high strain rate. The failure strength of the fiber did not depend on the gauge length of the sample, indicating that the distribution of any critical defects in the fiber is at an effective spacing of less than five millimeters. These results can be used in single-fiber-based constitutive models for numerical simulation of impact events on soft armor. This study will enable the design of novel vehicle and soft armor with UHMWPE to protect against IED threats and novel bullets.