



TOYOBO CO., LTD.
2-8 DOJIMAHAMA 2-CHOME, KITA-KU
OSAKA 530-8230 JAPAN
PHONE +81-6-6348-3130 FAX +81-6-6348-3413

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To Our Valued Customers:

As you are aware, Toyobo Co. Ltd. has regularly tested its Zylon® fiber in laboratory conditions designed to accelerate environmental conditions and to observe the effects of heat and humidity on Zylon fiber. Since 2001, Toyobo has periodically informed you of the results of those tests and has reported the results of our analysis of the tensile strength of Zylon fiber after it has been exposed to those conditions.

Experts in the ballistics industry have reported that the ballistic impact potential and behavior of a fiber-based armor system is based on a dimensional analysis of all the mechanical properties of the fibers to be used to construct the armor system. Tensile strength is just one factor. Other physical characteristics, or properties, used in any ballistic modeling include, among others modulus and elongation at break.

Those same experts maintain that one of the key parameters of the fiber is the modulus. In fact, many body armor industry experts and manufacturers believe fiber modulus is the single most important characteristic to be taken into account when designing or engineering a vest.

Modulus is an engineering term used to describe the resistance of fiber to stretch. In the field of engineering, modulus can really be thought of as a spring constant for a material. Engineers routinely conduct stress-strain tests to measure a fiber's modulus or ultimate strength before beginning to design with the material. In this test, a fiber is pulled apart, while the applied force is plotted against the amount of material stretch. The modulus is determined by measuring the slope of the stress-strain curve in the elastic region.

Recently, Toyobo has received inquiries about the modulus of Zylon fiber after exposure to high temperature and high humidity. Moreover, given the nature of issues which have arisen concerning the performance of Zylon in the context of body armor, we believe the data concerning modulus is relevant, if not important, to the discussion. Therefore, we are pleased to provide the attached chart which demonstrates that the tensile modulus for Zylon fiber remains constant even after exposure to 104 degrees Fahrenheit and 80% relative humidity for 24 hours a day, over almost 600 days. In fact, the aging effects on Zylon fiber under extreme temperature and humidity conditions show that the Zylon capability for energy dissipation remains constant and extremely high.

(Letter from Masakazu Saito page 2)

In order to properly assess and design an armor system, one needs to consider and evaluate all parameters as a system. We understand from experts in this field that the fiber tensile and fiber modulus “work” together along with the elongation and fiber direction/orientation in order to maximize and capture the full ballistic fiber potential. The correct system design should allow one to properly minimize the aging effect on the tensile strength.

Again, as a fiber manufacturer, Toyobo must defer to individual body armor manufacturers to take all such variables into consideration in order to reach a proper assessment of the efficacy of a final ballistic system performance, given the differences in manufacturing techniques and design, and the results of its testing.

Toyobo is pleased to be able to report this news and we thank you for your continued support of Zylon fiber.

Best regards,

A handwritten signature in black ink, appearing to read 'Masakazu Saito', with a long horizontal flourish extending to the right.

Masakazu Saito

General Manager, Zylon Department
Toyobo Co., Ltd.