

Creep Resistance of Dyneema® fiber

Dyneema® fibers prove to have the lowest creep rate compared to all commercially available UHMWPE fiber grades

In general, under constant loading ultra high molecular weight polyethylene (UHMWPE) fibers and rope show an irreversible elongation behavior. This phenomenon is known as creep, and it is a process in which the long molecular chains slide along each other. Most ropes made with UHMWPE fibers are not subjected to constant loads or are used at low average temperatures. For those, the creep property is not relevant.

The level of irreversible elongation of UHMWPE fibers is dependent upon the fiber grade, time, tension and temperature. For a rope made with UHMWPE fibers the creep rate and time to failure will depend on its linear weight, next to fiber grade, tension and temperature.

Amongst the UHMWPE fiber grades there is a difference in the creep resistance – each UHMWPE fiber grades has its own creep characteristics. UHMWPE fibers from Avient offer a low creep rate at a low rope weight. Ever since the commercialization of the UHMWPE fiber back in the 1990s, Avient has recognized the importance of creep in customer applications and has since run a multiyear research program to determine which variables have a bearing on UHMWPE fiber's resistance to creep. This led to the introduction of the SK78 fiber grade which offers good creep resistance properties for most of the applications in which UHMWPE fibers are used.

Further research led to Dyneema® Max Technology and the introduction of the DM20 fiber. This grade is a step change in creep performance compared to all other UHMWPE fiber grades. Dyneema® DM20 is designed for long-term or permanent loaded, like mooring offshore production platforms and floating offshore wind turbines.

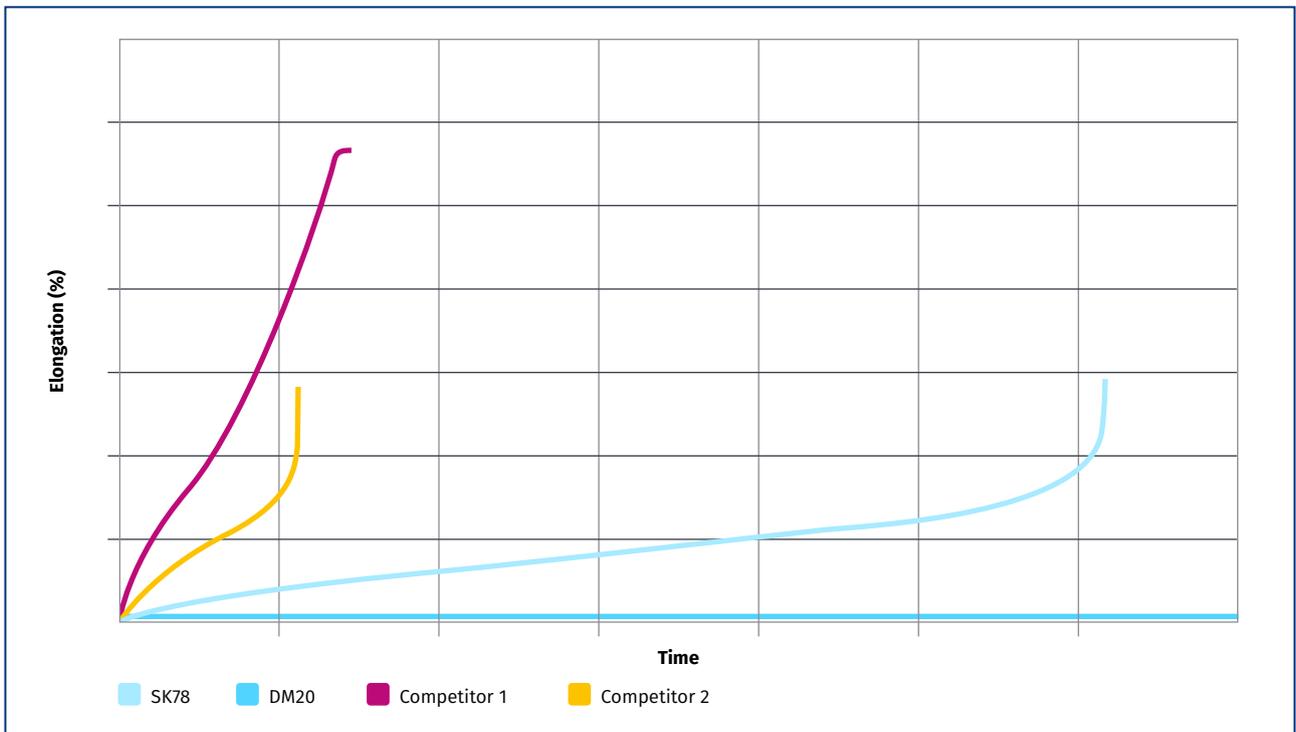
Over the course of the multiyear research program Avient has developed the Fatigue Performance Model, of which the core equations have been technology qualified by DNV. With this model and tool Avient is capable of predicting creep rate, elongation, and time to failure of applications made with their UHMWPE fibers.

Comparing fiber types in a 1,000 kN break strength rope

Fiber Type	Rope Core Weight (1,000 kN Break Strength)	Creep Load	Temperature	Creep Rate*	Creep Lifetime
DM20	650 g/m	200 kN	20 °C	0.0 %/yr	250 years
SK78				0.9 %/yr	15 years
SK75				2.6 %/yr	7 years

* Rope creep is dependent on UHMWPE fiber type, tension, time and temperature. Therefore these values are only indicative. For any other combination Avient shall be consulted.

Compared to all commercially available UHMWPE fiber grades, UHMWPE fibers from Avient prove to have the lowest creep rate, with DM20 as the best performer on creep rate and lifetime.



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