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Mooring of floating wind turbines: towards a reliable solution with polyamide lines

Polyamide seems to be a good candidate for mooring of floating wind turbines, but as this material deforms over time, it is necessary to qualify its long-term behaviour. This is the aim of the collaborative R&D projects POLYAMOOR (2017-2020) and MONAMOOR (2020-2024) led by France Energies Marines, Naval Energies and Ifremer. The experimentation carried out over nearly two years shows that the deformation is limited. Additional work indicates that it is possible to extrapolate the results of tests lasting only a few hours to the operating life of a farm (20 to 25 years).

Polyamide is an interesting material for wind turbine mooring, but its long-term behaviour must be characterised.

Among the options being explored for the mooring of future floating wind turbines is the semi-tensioned configuration with polyamide lines which allow the dynamics transmitted to the float to be damped and the footprint to be reduced. As the long-term behaviour of this type of synthetic fibre is not well known, its qualification for a period equivalent to the operating life of a wind farm (20 to 25 years) is a major challenge. Indeed, polyamide is a material with a complex behaviour that deforms over time if it is subjected to a load. This phenomenon, known as creep, if too pronounced, could lead to a relaxation of the mooring line tension and therefore a significant displacement of the wind turbine.

Two collaborative research projects to qualify tomorrow mooring.

This is the challenge of the unprecedented study conducted by Laure Civier and her co-authors as part of the collaborative projects POLYAMOOR and then MONAMOOR, which was recently published in the journal Ocean Engineering. A specific test bench was developed specifically to study the deformation of polyamide mooring lines. It allows three sub-rope samples to be tested in parallel. Each mooring line sample is immersed in a water-filled tube, put under constant tension by suspended weights, and then monitored for almost two years: a world first. Three levels of tension were tested: one representative of what is expected in normal times and two others that are higher, but compatible

with an average tension over a few hours during a storm. The results are clear: the cumulative creep is limited, and its speed is stable for the three tension values. **This information is crucial for the floating wind turbine industry, as it confirms that the service life of polyamide is compatible with that of a commercial wind farm. This opens the way for more widespread use of this material for mooring lines.**

Reliable characterisation of future polyamide lines within a few hours

In addition, the same experimentation was carried out on a hydraulic bench, used for shorter-term characterisations, for a period of three hours. The results obtained follow the same trend as the long-term tests. The creep curve developed with the data collected over a year thus shows the validity of extrapolating results from tests lasting only a few hours over several orders of magnitude. **This is another major conclusion for manufacturers in the sector, as the characterisation of their product can now be carried out reliably and quickly.**

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LERN MORE

To find out more, you can read the scientific article written by Laure Civier, Yoan Chevillotte, Guilhem Bles, Frédéric Montel, Peter Davies and Yann Marco, published in the journal Ocean Engineering in September 2022 under the title *Short and long term creep behaviour of polyamide ropes for mooring applications*.

▶ https://doi.org/10.1016/j.oceaneng.2022.111800

MONAMOOR project in short

The project is led by Ifremer and France Energies Marines.

➪ See the project web page

Duration: 42 months (2020-2023) | **Budget:** €2,047K