CREEP BEHAVIOUR OF COMPOSITE CYLINDERS AT SEA

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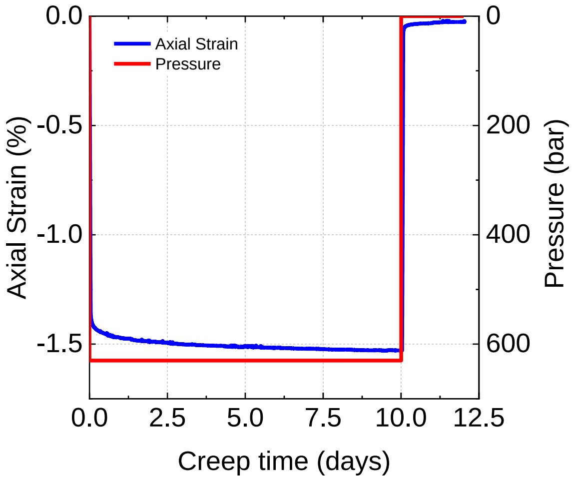
ABSTRACT

Oceans play a major role in regulating the Earth's climate. More especially, they mitigate the impacts induced by global warming as they absorb and store most of the heat, however up to a certain point. A change in water temperatures is now witnessed and this needs to be carefully monitored and understood. Nonetheless, more than 70% of the oceans still remains unexplored and to overcome this, specific exploration devices are needed [1]. At Ifremer, the use of pressure vessels for marine exploration has been the subject of many studies on both metallic and composite structures. The latter has received significant interest over the last two decades as these are much lighter than their metallic counterparts. These composite structures are mostly manufactured using filament winding. Different studies concerning the optimization of the laying sequence were performed to increase the implosion pressures [2] and different material systems were investigated over the years [3]. However, very few studies were focused on the long-term behaviour of these composite cylinders and more especially creep. During exploration at a given depth, creep is a major issue that needs to be addressed. The aim of the current study is to be able to predict the long-term creep behaviour of composite cylinders immersed at 6000 meters.

To do so, carbon/epoxy composite cylinders were manufactured by filament winding and tested within hyperbaric chambers at different pressures under creep loadings. All cylinders were instrumented with strain gauges, a composite tube is shown in Figure 1.a prior to testing. An example of results is then presented in Figure 1.b and shows the strain response of the composite cylinder subjected to a pressure of 630 bar for 10 days. This test was then followed by a 48h recovery which showed that the behaviour is reversible. Additional creep tests were then performed at higher pressures and up to implosion. Based on these tests, it was possible to describe the creep behaviour using models from literature in order to extrapolate the data obtained at 630 bar.

The presentation will focus on these aspects.

(a)



(b)

Figure 1: (a) Instrumented composite cylinder before creep test (b) Creep test performed at 630 bar for 10 days followed by a 48h recovery

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