

EXPERIMENTAL AND ANALYTICAL STUDY OF BENDING BEHAVIOR OF TEXTILE YARN UNDER EXTERNAL PRESSURE

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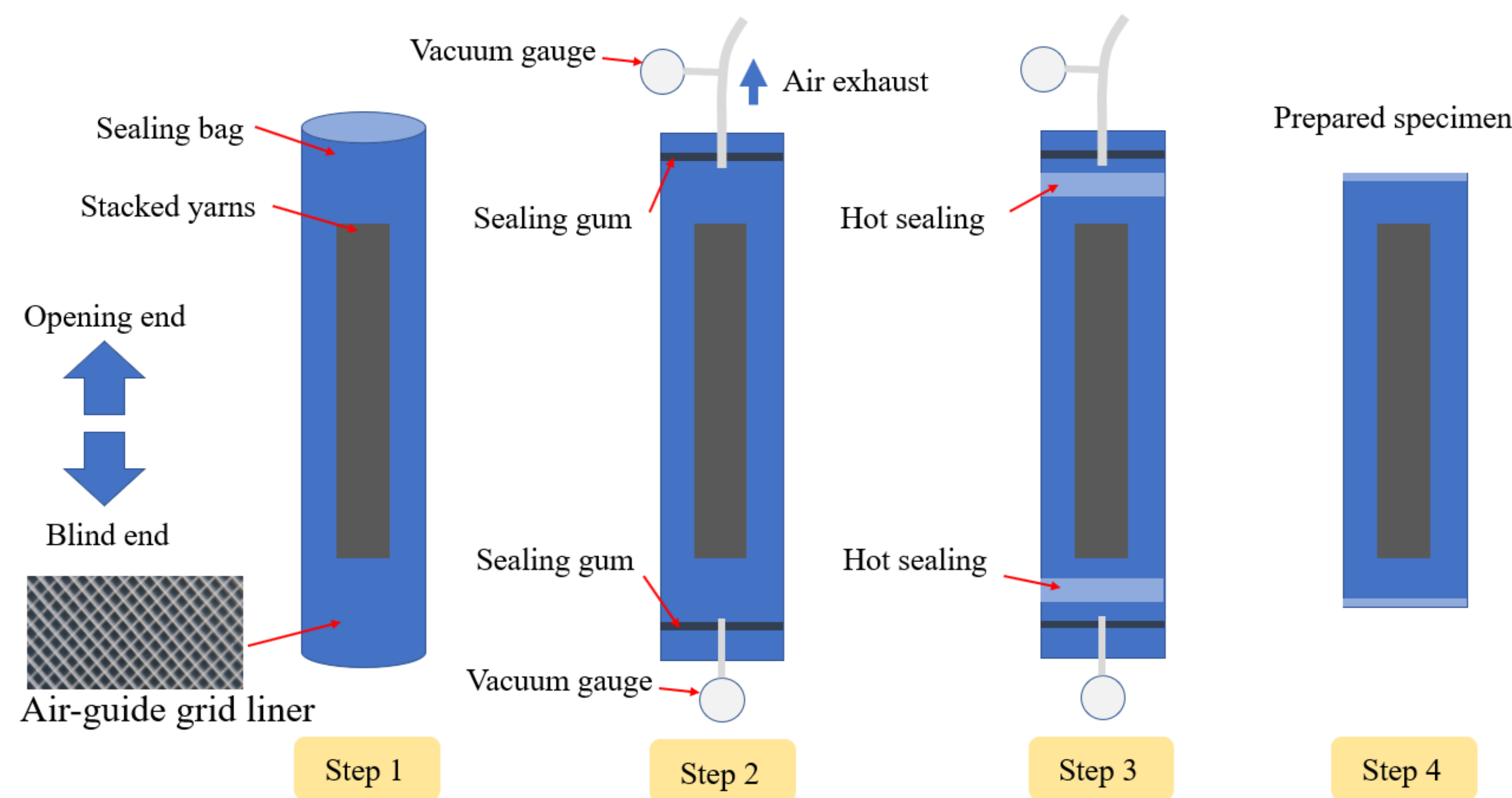
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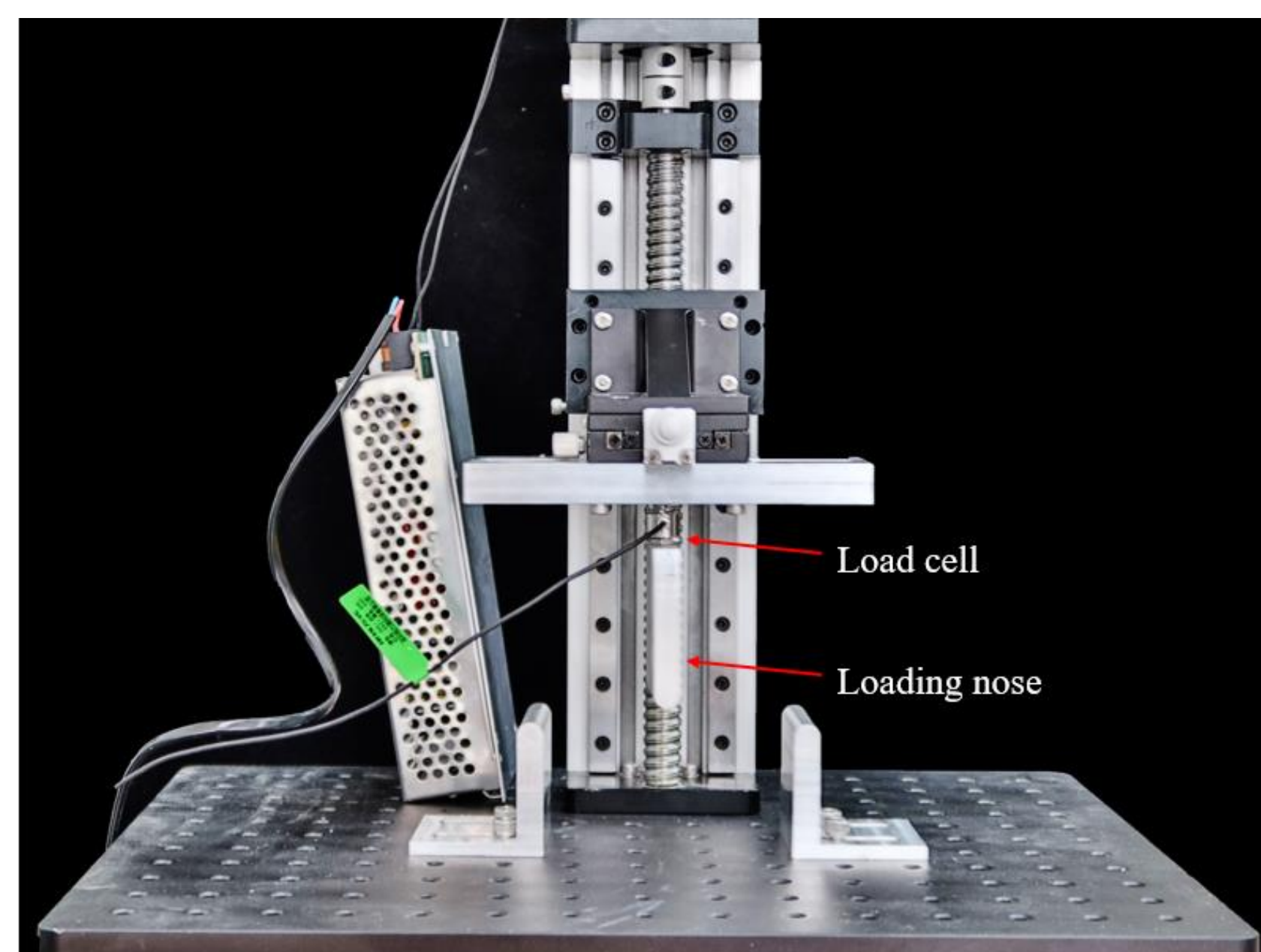
Introduction

Different from continuous material, the yarn in textiles exhibits high flexibility due to friction and slippage between fibers, making the textile reinforcements have excellent drapability. Understanding the mechanical behavior of the textile yarn is vital for predicting the forming process and optimizing the textile structure

Experimental test



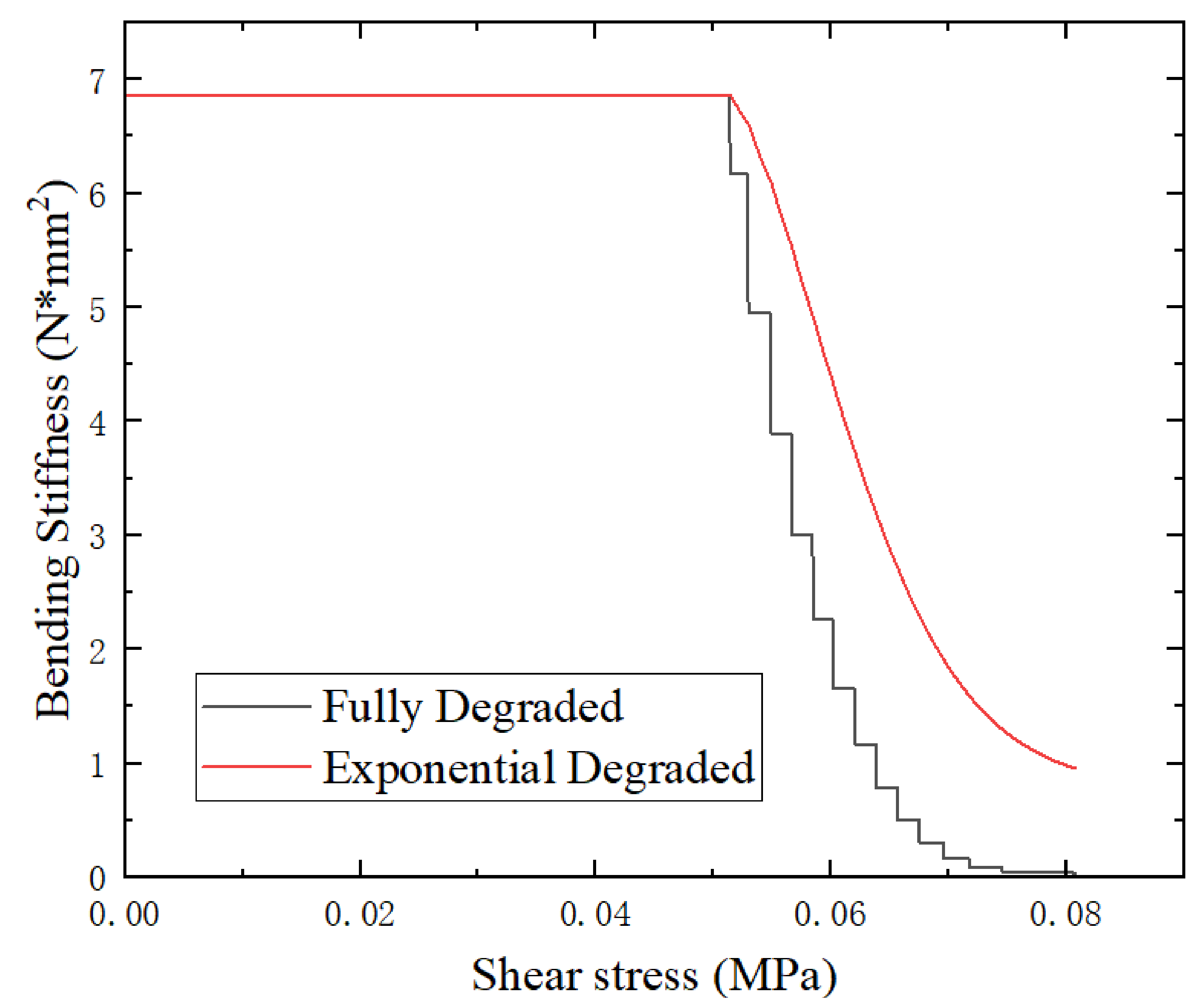
The carbon fiber yarn was enclosed in a sealing bag and evacuated at different levels to obtain different external pressure.



Custom-designed apparatus for three-point bending test

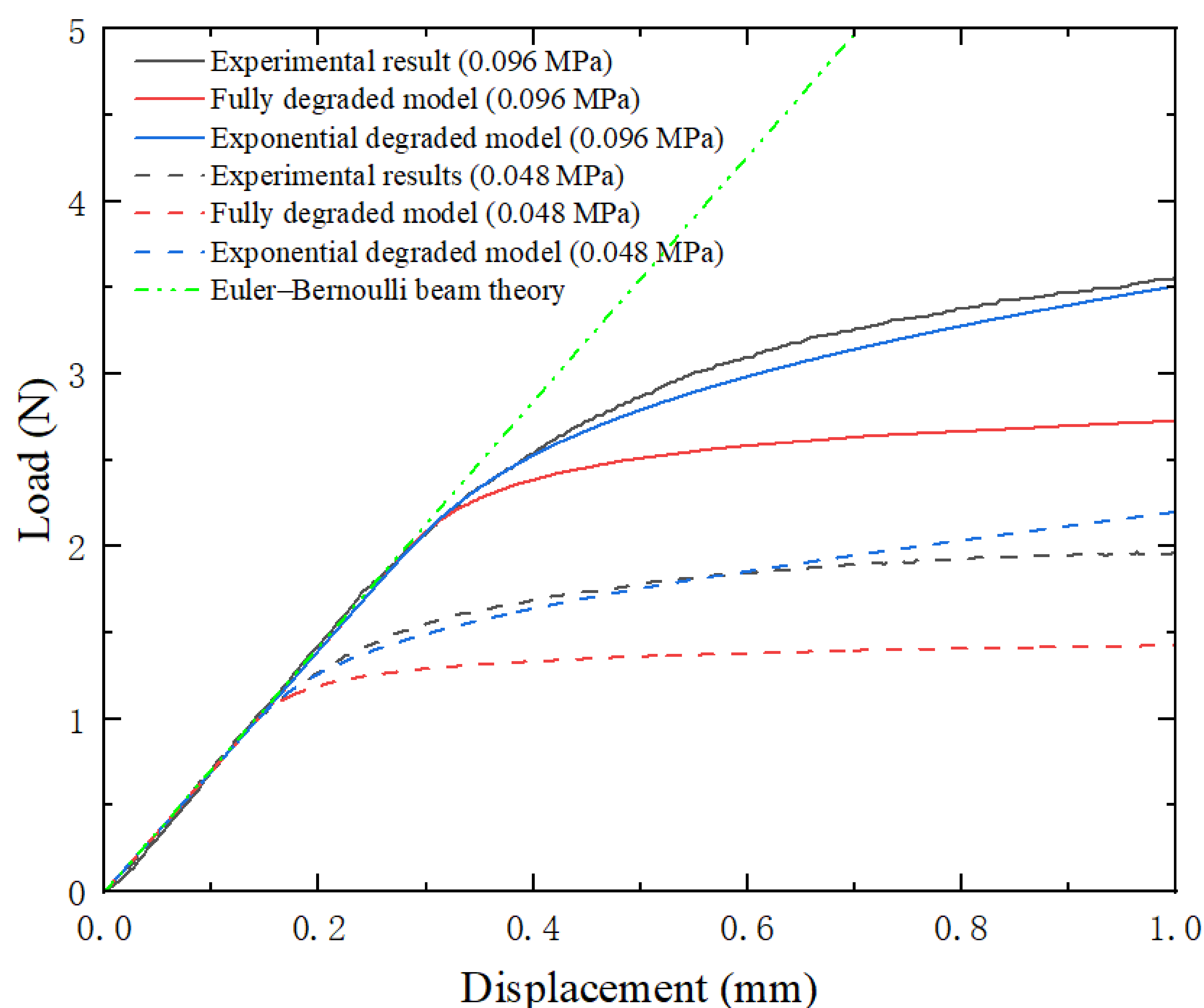
Analytical model

Based on the classical beam theory, an analytical model considering fiber slippage is proposed, which is able to accurately predict the bending stiffness degradation of the textile yarn under different external pressure. To avoid excessive degradation, an exponential degradation law is adopted.



Fully degraded and exponential degraded bending stiffness of the tested specimen as a function of shear stress.

Results and Conclusions



- The proposed experimental method successfully introduced external pressure during the test;
- The bending behavior of textile yarn is influenced by the external pressure
- The analytical model is able to accurately predict the bending stiffness degradation of the textile yarn under different external pressure
- This research provided new insights into the yarn bending behavior with the consideration of external pressure, which will help to understand the behavior of the yarn in textiles.