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# Optimizing the angle of winding carbon fiber reinforced plastic on the metal liner of the cryogenic pipeline

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*The study shows the importance of creating cryogenic pipelines for propulsion systems of aircraft from combined materials based on an ultra-thin steel liner and wound carbon fiber reinforced plastic. We analyzed the pipeline's cooldown to cryogenic temperatures and found out that due to a significant difference in coefficients of linear thermal expansion of the liner and carbon fiber reinforced plastic materials, the axial stability can be lost with the formation of plications in a thin-walled steel shell. We suggest a technique for determining and selecting the angle of winding carbon fiber reinforced plastic, in which the axial deformations of a thin-walled liner and a wound composite will have the same level of deformation.*

**Keywords:** pipeline, combined shell, cryogenic temperature, linear expansion coefficient

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