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C1Po1A-03 [22]: Effect of Leading-edge Geometry and Thickness on The Performance of Miniature Cryogenic Expansion Turbine

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The numerical simulation included solid blades with four different leading-edge thicknesses and four different leading-edge geometries. One of the geometries was square, one was ellipse a(ellipse ratio is 1), one was ellipse b(ellipse ratio is 2), and the other was ellipse c(ellipse ratio is 3). The four thicknesses were 0.7mm, 0.6mm, 0.5mm, 0.4mm. The results show increased efficiency loss for increased leading-edge thickness for square geometry. For ellipse geometries, there was no significant difference when the leading-edge thickness changed at the positive incidence range. For the same leading-edge thickness(0.7mm), square leading-edge caused more loss than ellipse leading-edge. For square geometry, the optimal incidence angle was about -8 degree(0.7mm). For ellipse geometries, the optimal incidence angle was about -30 degree(0.7mm). And with the decrease of leading-edge thickness, the square's optimal incidence angle was toward to zero degree, the ellipse's optimal incidence angle was toward to larger negative angle.

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