

Acoustic Speed Measurement of Nitrogen by the Cylinder Resonator

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In this paper, the cylindrical resonator was used to measure the acoustic speed of nitrogen at $T=(213\sim 420)$ K and $p=(0.05\sim 0.8)$ MPa. The radius and length of the cylindrical resonator were determined by fitting argon's acoustic speed data after correcting the boundary layer, duct, and shell motion perturbations. New shell motion correction formulas were used to reduce the discrepancy of different longitude (200, 300 and 400) and radial modes (001, 002 and 003). The acoustic speed of nitrogen has a relative uncertainty of less than 0.005%. The ideal-gas heat capacities, second and third acoustic virial coefficient of nitrogen were also presented.