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Transition in Hypersonic Boundary Layers: Role of Dilatational Waves YIDING ZHU, CHUANHONG ZHANG, QING TANG, HUIJING YUAN, JIEZHI WU, SHIYI CHEN, CUNBIAO LEE, Peking University, MOHAMED GAD-EL-HAK, Virginia Commonwealth University — Transition and turbulence production in a hypersonic boundary layer is investigated in a Mach 6 quiet wind tunnel using Rayleigh-scattering visualization, fast-response pressure measurements, and particle image velocimetry. It is found that the second-mode instability is a key modulator of the transition process. Although the second mode is primarily an acoustic wave, it causes the formation of high-frequency vortical waves. While the growing acoustic wave itself is rapidly annihilated due to its large and sharp dissipation peak that is enhanced by the bulk viscosity, the acoustically generated high-frequency vortical wave keeps growing and triggers a fast transition to turbulence.

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